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Building Up a Sales Force

SOME hold that salesmen, like poets, are born—not made, but this is only a partial truth. Unless a man (or woman—this being understood hereafter) has an ingrained aptitude for the work, he is unlikely to be an unqualified success. Nevertheless, this aptitude by itself is quite insufficient; it must be cultivated and directed upon the proper lines.

It is truer, therefore, to say that salesmen are both born and made. Given the suitable material, such courses as those instituted by the British Electrical Development Association can be relied upon to produce the right type of man with the requisite amount of knowledge for the job.

The avowed objects of the courses were stated at the outset to be: pointing ways of finding out the customer's needs; guiding interviews with customers; advising consumers how to use appliances; explaining the special merits of electricity; handling the question of competitive services; closing sales; and extending interest to the purchase of additional appliances.

It will be seen that one or two of these objects postulate the possession by the salesman of a certain amount of electrical knowledge. It is, perhaps, unfortunate, but the fact has to be faced that the sale of electricity and electrical appliances involves the imparting of technical information to customers; but this has to be so presented as not to appear technical, for nothing could be better calculated to frighten customers away.

Without a modicum of technical knowledge the salesman will be at a loss for answers to customers' questions and mere bluff will not always come off. To enable him to deal with the ordinary inquirer he need not be a member of the Institution or even hold a National Certificate. These higher qualifications are part of the equipment of the sales engineer, of whom more later.

The first fruits of the Salesmanship Courses will soon be apparent. The first examination is to take place later in the year and successful candidates will be awarded the E.D.A. Salesmanship Certificate. The possession of this by canvassers, salesmen and showroom assistants will be a tangible mark of their "paper" ability and a guide to employers in engaging such men and women.

Those of them who are additionally endowed by Nature with the other essentials will be entitled to be considered as fully qualified salesmen. As to women demonstrators, it has been suggested that the possession of the E.D.A. Certificate shall be a prerequisite for the award of the E.A.W. Diploma.

Sales engineers are another, quite distinct, class. Their business is not with the general public—it lies beyond the showroom. They have to persuade hard-bitten captains of industry and experienced engineers that electrical methods are superior to and cheaper than other methods.

Clearly the commonly accepted type of salesmanship will be of little avail in this case. Reasoned argument must take the place of the psychological arts which are brought to bear on the female customer in the showroom and for this the engineer-salesman must be well equipped technically.

The conditions for the award of the E.D.A. Diploma, as laid down by the Council, may seem a little hard to the average salesman but they are no more than the essential minimum. Indeed for the negotiation of large industrial loads a great deal more knowledge and experience is needed.

In this connection it is appropriate to refer to another scheme of training in salesmanship—that of the Electrical Power Engineers' Association, which is of a more advanced nature than the E.D.A. courses. In fact, it might broadly be said to aim at making salesmen out of engineers, while the E.D.A. scheme imparts some electrical knowledge to those who already have the makings of salesmen.

Together the two should be capable of providing the supply industry with a well-equipped sales force.

The Welding Art

THE excellent collection of welding plant and ancillary appliances at Olympia is an endeavour to satisfy a growing feeling in the heavier engineering and shipbuilding industries that a concerted display of welding equipment was necessary. For this purpose the organisers of the Engineering and Marine Exhibition have allocated a site which is large enough to be of importance, and most of the leading manufacturers have staged actual working demonstrations to assist them in emphasising recent advances in design and performance. This "exhibition within an exhibition" provides definite evidence of the tendency toward automatic actuation and greater exactness of electrical control. The object, of course, is to relieve the operator's dual task; by reducing the necessity for manual plant regulation he is freed to concentrate his undivided attention on the welding process. Not only does this mean speedier operation, but it will also inspire greater confidence in the work done. In the absence of a really infallible means of gauging the finished joint undestructively, anything which will help to ensure confidence in the soundness of properly welded structures is welcome.

Lightning

THE damage to the B.B.C. transmitting system at Westerglen, near Falkirk, last Sunday seems to have been accompanied by a spectacular display of high-voltage phenomena. While insulation for ordinary voltages could not be expected to stand up to a voltage that might have risen rapidly to a million or more, giving rise to a current that was probably between 50,000 and 200,000 A, the violence suggests that the tower-footing resistance may have been higher than is usually found with the masts that are used for power transmission. Nevertheless, this is said to have been the first section of the B.B.C. transmitter system ever to have received a direct stroke. In that case the B.B.C. may count itself lucky, as power engineers, according to Mr. F. C. Winfield's tentative suggestion, must expect a line section to be put out of commission by lightning once in every five years on an average.

Counting Cars

A KNOWLEDGE of the density of traffic at all hours of the day and night at important points is a necessary preliminary to devising plans for securing road safety. According to *Science* an electrical method of obtaining such statistics, in which two parallel infra-red beams, spread 30 in. apart, are directed on to photo-electric cells on the other side of the road, has proved itself both economical and accurate. The operation of the device is said to cost $150 per annum against $5,000 for a continuous manual check. The simultaneous interruption of the two beams is recorded by a counting mechanism with an accuracy from 1 to 2 per cent. Since the incidence of road accidents is considerably influenced by the number of vehicles passing per hour weighted during hours of darkness by illuminating values, the use of this simple method should give useful data.

The Smaller Undertakings

IN this issue we publish a report received from Mr. A. J. C. de Renzi, secretary to the Committee of Smaller Electricity Supply Undertakings, which indicates that after the lull of the summer recess a storm is gathering over the Government's electricity distribution proposals. The Committee has received information from a "reliable source" that the Government intends to fall back upon the proposals of the McGowan Committee, which would mean the absorption or amalgamation of undertakings whose output during the year ended March 31st, 1936, did not exceed ten million kWh. The Committee was formed last year to combat this proposal. It has already formulated a scheme of its own which provides for action by the Electricity Commissioners to secure some measure of reorganisation in what is considered to be a more equitable manner. This scheme was presented to the Prime Minister and the Minister of Transport, and it is now proposed to reinforce this appeal by means of a deputation to Dr. Burgin. A matter particularly stressed is the necessity for retaining the "personal touch," which is claimed to be an outstanding advantage of local electricity supply administration.

Apprentices on Strike

SEVERAL electrical concerns in the Manchester area are affected by the strike of 10,000 apprentices, which has now been in progress for about a fortnight. They are seeking to enforce a claim for an increase of 3s. a week in their wages and to secure the right of the engineering trade unions to negotiate on their behalf. The employers' association had agreed that the matters should be considered on October 4th, but the lads refused to wait until then and "downed tools." The unions seem disposed to treat them on a similar basis to adult members and issue strike pay. Negotiations regarding "recognition" are proceeding between the unions and the Employers' Federation. Where apprentices are definitely indentured they are bound by the terms of their agreements, but there is an increasingly large number of lads who, apparently, are not so bound, and in their case negotiations regarding wages and conditions might conceivably be put into the hands of the unions. The latest reports received before we went to press indicated that, while numbers of the apprentices were returning, others were ceasing work.

Labour Saving

EXPONENTS of the electrical idea stress the labour-saving attributes of electricity. They would surely obtain testimony of the truth of their arguments from an American woman whose husband recently sought a divorce. According to the *Daily Mail*, this man, in the kindness of his heart, bought his spouse an electric sewing-machine. To demonstrate its operation he made a dress, and apparently did it so well that he was forced to continue his dressmaking. He subsequently purchased some electric cooking equipment and undertook to coach his wife in its use, with the result that his demonstrations became continuous. After that he bought a washing-machine—but the judge had heard enough and granted his application.

Lighting in Mines

A REALISATION of the need for the better illumination of underground workings in collieries has been brought about during the past ten years or so, mainly as a result of increasing mechanisation. To this cause, rather than to an appreciation of the lower overall production costs or of the reduction in the number of accidents or of remedying nystagmus, Mr. W. Maurice, in a written communication to the *Journal* of the Institution of Electrical Engineers, attributes the acceptance of high candle-power lamps by the mining industry. Thus the use of electric power is securing an improvement in lighting, again provided by electricity, to the benefit of the miner's health.

Short-Circuit Calculations

A FEW years ago the annual report of the Electrical Inspector of Factories referred to the disturbing feature that often neither the minimum short-circuit input nor the makers' rating of switchgear were known to those responsible, whether supply or works engineers. This was, no doubt, partly due to retention from early days of scepticism in regard to reputed rupturing capacity, which caused the laborious calculations then involved to be shirked. Now that so much more is known about the performance of circuit-breakers, as Mr. C. J. O. Garrard's article in this issue shows, such a fatalistic attitude cannot be justified.

Rural Electrification.

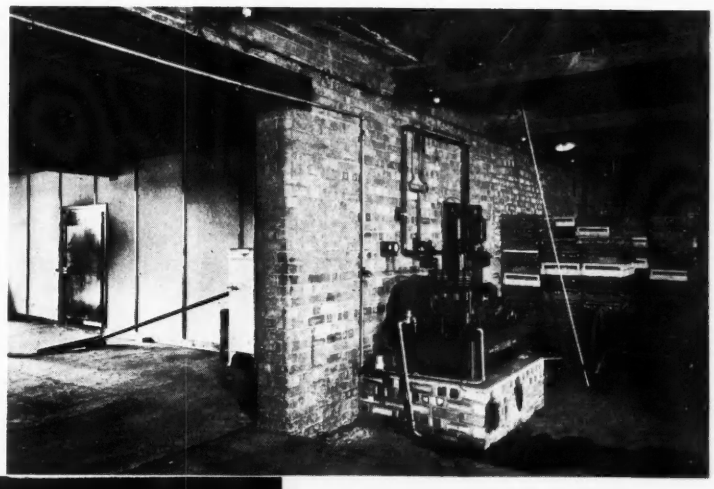
By E. W. Golding, M.Sc.(Tech.), A.M.I.E.E.

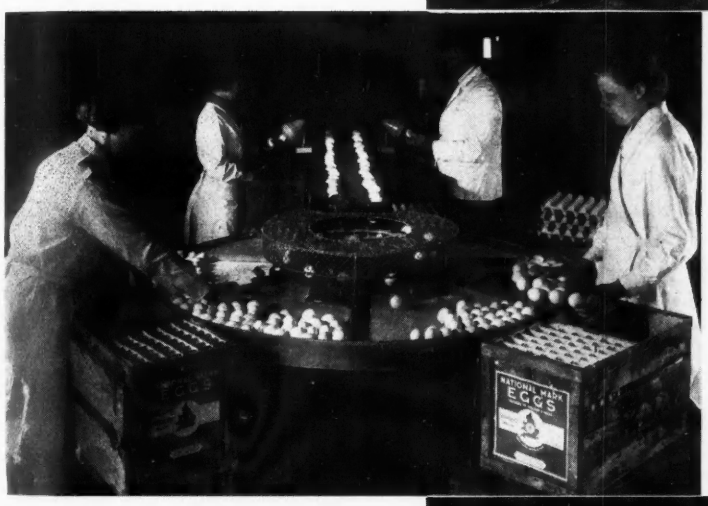
Its potentialities and the requirements of agriculture

THE Government's proposals for the reorganisation of electricity distribution, based on the recommendations of the McGowan Committee, have intensified discussion of the future prospects of rural electrification. The Electricity Act of 1926, resulting in the reorganisation of generation and main transmission, was the first important step towards providing cheap electricity for all. But this left untouched the almost equally important problem of efficient distribution.

Speaking generally, urban districts have little to complain of, as the large increase in consumption during the last few years indicates. In rural districts, however, which in England and Wales form 89 per cent. of the total area of the country (58,300 sq. miles) and have a population of about eight millions, the position is still far from satisfactory. But for this it is doubtful whether any drastic reorganisation of the electricity distribution system would be considered necessary.

Both the circumstances attending the formation and growth of the many supply undertakings and the legislation regulating electricity supply, have brought about a division of the country into areas which are, in many cases, far from ideal from the distribution point of view. Many supply undertakings, naturally, concentrated on the development of the more densely populated areas. Out of approximately fifteen million premises in Great Britain about eight million are at present connected to public supply systems, the percentage connections being about sixty in urban areas and thirty-five in rural. At the same time supply powers have now been granted for an area containing about 98 per cent. of the total population.





The average density of population in rural areas is 154 per sq. mile, compared with 685 for the country as a whole. Incidentally, although the population per sq. mile in the former case is low, its distribution is not uniform, so that even in rural areas there are relatively thickly populated districts which can be served by distribution lines early in the development, leaving outlying areas to be reached later. The total number of rural premises is of the order of 2½ to 3 million, while the total number of farms is over 388,000. The latter vary in size from smallholdings of between one and five acres to farms of several hundred acres, as shown in Table I.

About half of the total agricultural area is occupied by large farms (above 150 acres), while as regards numbers almost 80 per cent. of the total holdings are under 100 acres in extent.

The total number of individuals employed in agriculture in this country is about 1,200,000, and the capital invested in the industry is rather more than £1,000 million. The annual value of the agricultural output in England and Wales is approximately £200 million. These figures indicate the very considerable economic importance of agriculture; this is often overlooked, its strategic importance being more commonly stressed.

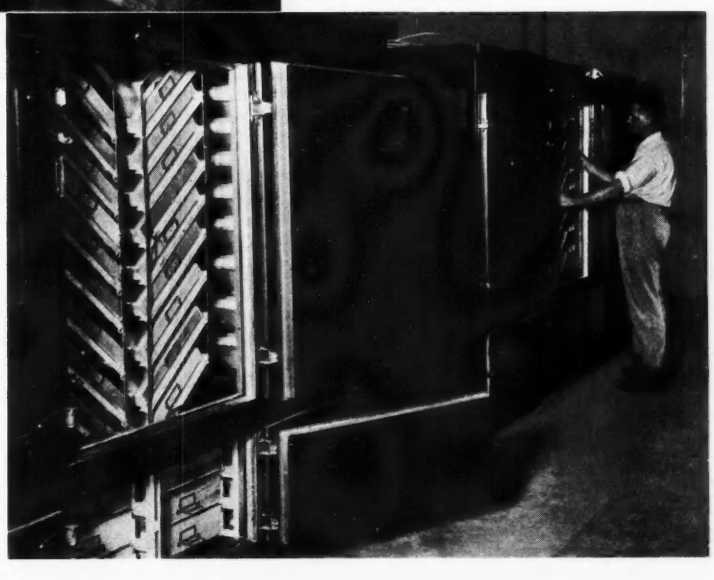
It is difficult to obtain exact figures for the number of rural premises still unconnected to public electricity supplies, but the total number of farms is over 388,000. The latter vary in 360,000 farms, of which only some 25,000 to 30,000 are supplied at the moment.

Probable Loads and Installations

The load obtainable from a farm is influenced by its nature as well as by its size and other less obvious factors. Neither the size nor the type alone may be regarded as a criterion of the power demand. Thus an arable farm, especially in a corn-growing district, may be large but may have a small potential load, while a small dairy farm, or an even smaller poultry farm, may make a comparatively large demand.

The electrical installation on a farm can be divided into two distinct parts: that for the farmhouse and that for the farm buildings. As regards the former, although the size of house varies somewhat with that of the farm, the potential load will not be very different from that of a middle-class house in urban districts unless a dairy is attached to the house

Above: An air-conditioned store on a Lincolnshire bulb farm. Left: Egg grading at the Bishop's Stortford egg-packing station. Below: Electrically operated incubators



when the load may be considerably greater, but, strictly, a dairy should be classed as a farm building.

The somewhat lower spending capacity of rural inhabitants tends to be offset owing to the farmhouse being much more of a "workshop" than is the average town house. The farmhouse is the natural centre for the various farm operations and frequently has to serve the purposes of offices, laundry, general cleaning depôt and store room, in addition to performing its purely domestic functions which, in themselves, are more important than in many town houses since workpeople are often catered for as well as the farmer's family. Again, the absence

TABLE I.

Size of farm. (Acres.)	Number of farms.*	Percentage of total number.	Percentage of total acreage.
1 to 5	70,000	18.0	0.8
5 to 20	101,000	25.9	5.0
20 to 50	77,000	19.8	10.6
50 to 100	62,000	16.0	18.4
100 to 150	32,000	8.3	15.8
150 to 300	35,000	8.9	30.7
Above 300	12,000	3.1	18.7

* To the nearest thousand.

of certain other amenities which are available to the urban dweller tends to make the convenience of electricity all the more appreciated, so that, provided the price is not excessive, a greater proportion of the total sum allocated to domestic purposes will be spent on electricity than is the case in urban districts where there are so many competing attractions.

As an example of this, the large number of electric cookers already in use in country districts must surprise many who predicted a very limited field for them. My experience is that the farmer's wife is usually enthusiastic about electric cookers, especially for the preparation of early breakfasts and for baking, the reason being that they are so much quicker and more convenient than the old-fashioned and cumbersome cooking ranges which are a feature of many farm kitchens.

Except with regard to lighting one cannot generalise concerning the possible load obtainable even from the farmhouse alone. The supply tariff must, of course, influence the matter very largely. However, if this is satisfactory, the installation in a farmhouse may be somewhat as follows: Lighting, 15 to 25 points; cooker, 6 kW; fires, 4 kW; water heater, 2 kW; iron, kettle, and miscellaneous, 2½ kW. Thus the total capacity of the domestic installation may be about 15 kW.

As an estimate of the total potential connected load for farmhouses alone, taking an average of only 10 kW and assuming that 70 per cent. of the at present unelectrified farms will be connected to supplies eventually, we obtain the figure of 2½ million kW. Taking the same percentage of rural premises other than farmhouses and assuming an average of 4 kW, we have another 3 million kW of potential connections.

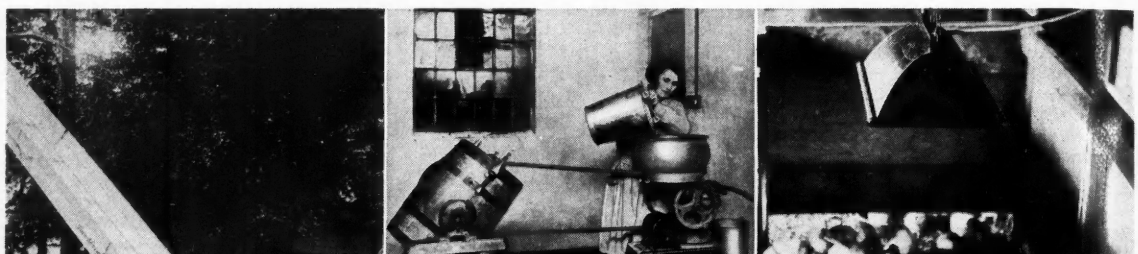
Power in Farm Buildings

For the present the use of electric power for cultivation and field work generally must be ruled out. If this could be undertaken electrically, the load obtainable would be so large that economic supply in rural districts would rapidly cease to present a difficult problem. Although attempts have been made to adapt electricity to field work by utilising a modification of the steam ploughing system, these have not been an unqualified success in this country, although their reception on the Continent has been more favourable. One cannot envisage any important change in this situation taking place without the introduction of much simpler methods than have hitherto been suggested.

Various factors operate, however, to render the situation less difficult from the electrical point of view than would appear at first sight. Thus, for field work, the two sources of power in common use are the horse and the tractor. The former, being capable only of plain draught, or traction, can be ruled out as a source of power for the drive of machines in and around farm buildings. The tractor can be used for this purpose, although it is certainly not ideal from several points of view, but it is already available and therefore might as well be used as fully as possible.

Another aspect of the matter appears when we consider the size of farms. Some 80 per cent. of these are of less than 100 acres extent and on many a tractor is not economically justifiable, horses being used instead. Again, on the very large farms the size justifies some specialisation as regards power units, there being sufficient work for each to carry out the function for which it is best suited. The conclusion to be drawn—confirmed by experience to date on electrified farms—is that there is very definite scope for electric drive in and around the farm buildings, although this is perhaps less so in the case of the comparatively small number of medium-sized farms possessing a tractor which would be underworked unless used for certain small power purposes.

Competition for the drive of barn machinery exists, of course, in the form of stationary oil engines with low fuel costs, but their overhead charges are high and the greater convenience and flexibility of electric drive is greatly in favour of the latter, provided the tariff is reasonable. I am convinced that the protagonists of oil engines usually fail to take into account the comparatively small number of hours of use on farms. This means that the high capital charges have a much greater influence upon the overall cost per h.p.-hour than have the low fuel costs, whereas the capital and maintenance charges on electric motors are much smaller.



Left: A portable motor in use on a farm. Centre: Butter-making equipment, motor operated. Right: Chicks basking in the warmth of an electric radiator

Barn Machinery

The total installed capacity depends upon the method of drive adopted. This may be individual, line shaft or by portable motors. If, regardless of capital outlay, a separate motor were used for barn machines for purposes such as root-cutting, chaff-cutting, mixing, grinding and crushing, pumping and elevating, some 20 to 30 h.p. might be required. While this might be ideal from some points of view the cost would usually be too high. Most barn machines, except grinding mills, require less than 5 h.p., so that a 5-h.p. motor, either portable or driving line shafting, would be sufficient for most purposes. For a grinder as much as 10 or 12 h.p. may be necessary. 12 to 15 h.p. is required for threshing, 1 to 3 h.p. for pumping and ½ to 2 h.p. for a milking machine. Threshing is frequently done by contract on small farms, but as electrification progresses electric drive will probably be used more frequently.

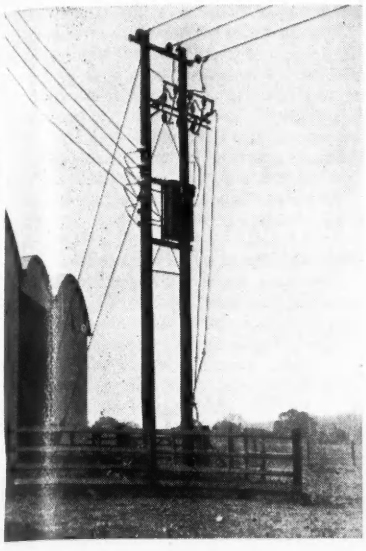
For the drive in a small dairy only about 2 h.p. is required, although individual drive is more common and the aggregate horse-power may be 3 or 4. A sterilising chest will require about 8 kW. Most of the poultry farming appliances require only small power, but the aggregate might be 5 kW or more.

As regards lighting in buildings, the number of points varies with the area of farm to which, also, the size of the buildings is roughly proportional. A figure of twelve lights per 100 acres of farm is reasonable.

Exclusive of the domestic equipment, some 5 to 10 kW in the case of a small or medium farm, and 10 to 20 kW for a large farm cannot be regarded as excessive. Taking an average of 10 kW for, say, 200,000 farms, we have a potential load of 2 million kWh for farm buildings alone. When added to the previous estimates for domestic and other uses in rural dis-

tricts we have the impressive total of 7½ million kW—almost equivalent to the total capacity of generating plant in public supply stations in Great Britain in 1934-35.

The significance of this total lies rather in the demand for equipment which would result from rural electrification than in its effect upon generating plant. The average yearly load factor of undertakings throughout the country is only about 33 per cent. Owing to the diversity which would be obtained by the addition of a large rural load this average figure might be increased, but the increase in the capacity of generating plant required would probably be comparatively small. Even with a satisfactory tariff and progressive methods this load would require some years for its development. It has been found that five or six years have elapsed before 70 or 80 per cent. of the premises in a progressive rural area have been connected. The building of the load up to the magnitude stated would take further time after the date of connection. Of the rural premises already connected very few can be said to be completely electrified, so that additional load from these may be looked for.



A 20-kVA transformer pole in the Basingstoke Electricity Department's area

Energy Consumption

Owing to the comparatively small number of hours of use of electrically driven machines on farms the annual consumption of energy may often seem disappointing. The largest consumptions up to the present have usually been obtained on poultry and dairy farms, annual figures of from 20,000 to 50,000 kWh being recorded in some cases. The average consumption, taking a large number of farms spread over a wide area so as to include different types, has been of the order of 2,000 kWh per annum, although, if those farms having a consumption of less than 1,000 kWh and using electricity for little more than lighting, are excluded, the average is about 4,000 to 5,000 kWh. The short period for which many of these farms have been connected and the somewhat high tariffs in some districts justify the conclusion that the average consumption to be expected when rural electrification has been more nearly completed with presumably lower tariffs than at present will be of the order of 5,000 kWh.

Considering rural districts as a whole the annual consumption per consumer in the more progressive areas has already risen to about 1,200 kWh, and, in the future, a figure of 2,000 is not, perhaps, unduly optimistic. It is estimated that between 3 and 4 million rural inhabitants or, say, ¾ million consumers are still without a supply, so that a total consumption from this source of between 1,000 and 2,000 million kWh may be attained eventually. Figures of 100 to 200 kWh per head of population have already been achieved by some rural undertakings. On this basis, again, about 1,000 million kWh appears as a possible consumption.

Mill belt-driven by a 10-h.p. motor. The grinder seen in the centre has a fractional h.p. motor

Tariffs and Development

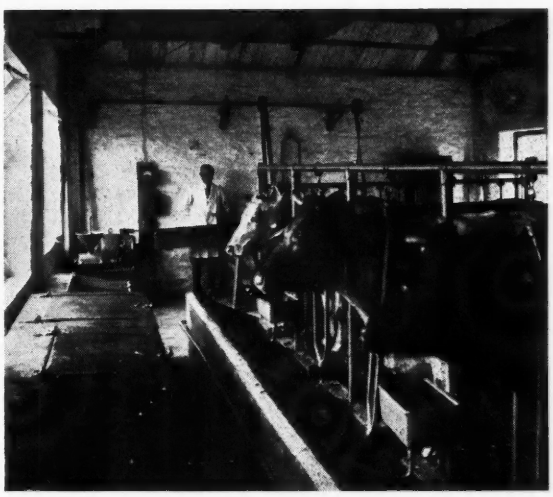
A satisfactory two-part tariff must be offered if progress is to be made. As a basis of the fixed charge perhaps floor area is the best provided that due account is taken of the fact that many old farmhouses are "rambling," so that assessment on the whole area of the house may lead to an excessive charge.

Since the use of electricity on farms cannot be considerably extended unless the charges are such as the farmer will find economical, Table II, showing the economic prices per kWh for various uses, has been drawn up, *i.e.*, the price at which electricity will compete favourably with such other sources of power as are available on most farms.

TABLE II.

Use.	Economic price per kWh.	Possible average consumption kWh per annum.
Lighting and small power appliances in house and buildings	4d.	500.
Milking machines	1½d. to 2d.	30 to 40 per cow.
Barn machinery	1d. to 1½d.	1,000.
Domestic heating, cooking and water heating	1d.	1,000 to 3,000.
Soil heating	1d.	2,000.
Poultry farming	¾d. to 1d.	4,000.
Hop drying	¾d.	5,000.
Grass drying	¾d.	10,000 and upwards.
Sterilising and hot water for dairies...	½d. to ¾d.	2,000.
Greenhouse heating	¼d.	3,000

Considerable variation in consumption is inevitable, but the values given are of the right order and, at least, they serve for a comparison of the relative importance of the various loads. Although some uses, such as greenhouse heating, necessitate a very low charge, these prices are not impossible of attainment by rural undertakings, especially since supplies will be taken for several purposes. A mixed load raises the average revenue per kWh sold whilst the total revenue remains within the economic limits from the consumer's point of view. Thus, for example, a consumer using 500 kWh for lighting, &c., 1,000 for barn machinery, 1,500 for milking and 2,000 for domestic power and water heating could afford to pay, on the basis of table II, an annual sum of £32. On a two-part tariff with a fixed charge which is merely sufficient to cover the lighting kWh (at 4d.), namely £8 10s. per annum, the remaining £23 10s. would be produced by a kWh charge of ¾d., the latter being well within the economic limits for the power uses.



A cowhouse equipped with electric food-chopping plant, &c.

Railway Electrification

A course of nineteen weekly lectures on "Railway Electric Traction" has been arranged by the Department of Engineering (Professor H. W. Swift), of the University of Sheffield, with the co-operation of the Metropolitan-Vickers Electrical Co. The first lecture will be delivered on October 8th, when Mr. G. H. Fletcher (president of the Joint Committee of the I.E.C., the I.U.T., and the I.U.R.) will survey the present position of railway electrification and possible lines of future development. More detailed technical aspects will be dealt with by other authorities in later lectures, all of which will be followed by discussions. Further particulars are obtainable from the Registrar of the Department of Applied Science.

Drainage in East Anglia

Wind pumps supplanted by modern electrically driven plant

THE bad floods of last winter directed public attention to the marshlands of East Anglia, but the drainage problem is no new one. For centuries men have been struggling to rid these low-lying lands of flood water, and a new round in the contest was begun recently in the Acle district, near Norwich, when electrically driven pumping plants were put into operation.

The latest of these was formally put into operation by Captain Cator, chairman of the Middle Bure Internal Drainage Board. This plant is at Hermitage Drainage Level and is housed in the shell of the original wind-pump, which was augmented sixty-three years ago by a steam engine built by the grandfather of the "Sons" of Messrs. Thomas Smithdale and Sons, makers of the latest pumping plant. This engine was made in premises which were taken over more than fifty years ago by Mr. W. H. Scott, whose firm has supplied the electric motor for the present installation. Further, the old engine went into the foundry and some of its metal is incorporated in the new pump.

The installation consists of a 25-h.p. vertical-spindle slip-ring motor running at 365 r.p.m., by Laurence, Scott & Electromotors, Ltd., driving a submerged centrifugal pump made by Smithdale's to their own designs. The pump is designed for dealing efficiently with the low heads usual in such drainage work, and to need little skilled attention—the fatter feature being important in view of the isolated position of some of the pumping stations. This unit deals with water drained from an area of about 700 acres, and pumps about 30 tons per min. It will therefore deal with a rainfall of 1 in. over the area in about forty hours, and has enabled a steam pumping station to be shut down. Power is supplied by overhead line from the Yarmouth Corporation mains at 400 V three-phase.

A similar set has been installed at Heronby Hall, the residence of Mr. C. W. Waters, chairman of the East Norfolk Catchment Board. Here there was a steam pumping station which was erected in 1857, and until last winter the simple non-condensing engine and locomotive type boiler still did duty. The engine, in its "spare time," drove a flour mill, root cutters, &c., through belting, the main drive to the pump being through wooden toothed gearing.

The new plant, which also consists of an L.S.E. motor and Smithdale pump, deals with water from about 900 acres and takes the place of the steam plant and three wind pumps. One of the latter is said to be 300 years old and is certainly one of the oldest cloth-sail pumps in Norwich. It has been kept in repair and is still capable of service, although it is not likely that it will be used again. The pumpman had to keep the sails headed into the wind, and to "trim sail" as necessary, perhaps in a gale of wind and rain and by the uncertain light of a hurricane lamp. If he failed in his job the whole top, sails and all, came over. The wooden gear wheels, brake mechanism, sweeps, &c., are in a wonderful state of preservation and reflect great credit on the original craftsmen, but there is no doubt that the pumpman has more admiration for the simplicity of the new plant.

There are places in this district from which twenty or more wind pumps can be seen. Few will regret, for other than sentimental reasons, that the days of their uncertain service are passing.

Old and New Methods of Marsh Drainage in East Anglia

(1) An old wind pump modified to house the electrical plant shown in (3). (2) This wind pump, said to be 300 years old, is one of three which, together with steam plant, have been replaced by motor-operated pumps. (3) The new plant at Hermitage Drainage Level. (4) The Heronby Hall equipment

Calculating Fault Currents. By C. J. O. Garrard

Accurate values in low-voltage systems

A LIMIT to the breaking capacity of circuit-breakers, as the voltage is reduced below, say, 1,000 V, is imposed by the maximum making and breaking current for which they can be economically constructed. General agreement has been reached that at 660 V the maximum economical rating is about 50,000 kVA, corresponding to a breaking capacity current of 44,000 A. At voltages below 660 the breaking capacity current is still limited to this value, so that the breaking capacity in kVA is reduced in proportion to the voltage.

A system layout, therefore, must not lead to the possibility of fault currents exceeding the maximum permissible values. Usually, the most economical and convenient method of preventing this is by sub-division of the network. The obligation to limit fault currents to comparatively low values and the greater exactitude with which circuit-breaker ratings are now assigned make it necessary to calculate the possible short-circuit currents with a fairly high degree of accuracy. The risk of danger due to underestimation of the fault current and of waste of money due to overestimation can thus be avoided. In the past, owing to the exaggerated ratings assigned to breakers, somewhat crude methods of calculation have been employed, entailing the neglect of certain factors having an influence upon the result. Thus it has been common practice, where low-voltage networks have been fed by transformers, to calculate the short-circuit current solely with reference to the kVA capacity and leakage reactance of the transformers.

A realisation that such methods give inflated values for the fault currents has led to equally exaggerated statements as to the degree of inflation. One has seen pronouncements to the effect that the real value of the current would be from 50 to 70 per cent. of the calculated value, and so on. The possible error will depend upon the method of calculation used, and the object of this article is to point out the precautions that must be taken and the corrections that must be applied to secure reasonable accuracy and to indicate the order of magnitude of the errors likely to be encountered.

Breaking Current

(*a*) *Circuit constants.*—It is a waste of time to calculate breaking current accurately unless the original data are reliable. The data upon which short-circuit calculations are based are the alternator and transformer characteristics and the impedances of the transmission conductors and choke coils.

It is required to ascertain, in effect, what value the short-circuit current of each alternator attains at any given time after its terminals are short-circuited, a known excitation being applied. For convenience this information is usually given in the form of "reactances," which allow of initial values of the various components of the short-circuit current being calculated, and of "time constants" which define their subsequent variations. For old machines it is often difficult or impossible to obtain accurate reactance values and a conservative value has to be assumed, in which case a high degree of accuracy in the subsequent calculations is superfluous. Approximate values are given in the accompanying table. In what follows, however, the assumption is that reasonably accurate values of the alternator characteristics, say, within plus or minus 5 per cent. are obtainable.

Per cent. reactance referred to full-load kVA of machine

	Old machine (1)	Modern machine (2)
Turbo-alternators ...	9 to 11	14 to 16
Salient-pole alternators and synchronous motors	10 to 12	16 to 18

	100 to 1,000 kVA.	1,500 to 5,000 kVA.	Above 5,000 kVA.
Transformers	4.5 to 6.5	7 to 8	9 to 10

(1) The reactances of synchronous machines vary widely according to the date at which they were constructed, the country of origin and the idiosyncracies of the manufacturer and buyer. These figures may be taken as typical of any machine made before, say, 1920 to 1925. (2) These figures may be taken as approximate values for any machine made after, say, 1920 to 1925.

It is now common to design alternators with a fairly high reactance in order to guard against damage to the windings from dead short-circuits, and to check the design by means of short-circuit tests. Makers are thus usually in a position to provide the required information.

The reactance that determines the initial instantaneous short-circuit current of an alternator is the leakage reactance of the stator windings in the slots and overhangs. It is sometimes measured by removing the rotor and applying to the stator winding a reduced voltage at the normal frequency. The leakage reactance so measured includes a proportion due to the flux passing across the bore. This proportion may be calculated with reasonable accuracy, and in the case of alternators with damping windings or of turbo-generators with solid rotors should be subtracted before the measured value of reactance is used for short-circuit calculations. The reason for this is that during short-circuit the induced currents in the damping winding or solid rotor due to this flux are sufficient to prevent its taking up any but a very small value. With salient-pole machines without damping windings the bore flux should be included when calculating leakage reactance.

Mr. C. J. O. Garrard, M.Sc., A.M.I.E.E.

The precise value taken for the alternator reactance is less important as the external impedance becomes relatively great. Thus, imagine that a low-voltage system, the fault current of which corresponds to 25,000 kVA, is fed through transformers and long cables from a 50,000-kVA alternator. An error of 20 per cent. in the value of the alternator reactance produces an error of only 1.5 per cent. in the calculated value of the low-voltage short-circuit current. But if a l.v. system is fed directly by its own alternators it is important to know their reactances accurately.

The magnitude of the d.c. component of the instantaneous short-circuit current depends upon the instant at which the circuit is made in the phase in question. The rapidity with which it disappears depends upon the ratio between the resistance and reactance of the short-circuit path. This is of importance in calculating the making current particularly for low-voltage circuit breakers. Here again it is the leakage reactance of the stator winding that must be used in calculations.

The relationship between the leakage reactance and the internal resistance in large alternators is such that the time constant of the d.c. component during a short-circuit on the terminals is about 0.1 to 0.2 sec.; *i.e.*, if the leakage reactance is 15 per cent. the effective resistance drop is about 0.3 per cent. or about 2 to 3 per cent. of the reactance. If the resistance of the external circuit is considerable as compared with its reactance, the rapidity with which the d.c. component disappears is increased.

The decrement of the alternating component of the short-circuit current under the influence of armature reaction, *i.e.*, the rapidity with which it decreases to the final steady value, depends also upon the impedance of the external circuit. The mean time constant of the alternating component is for large synchronous machines and terminal short-circuits about 1 sec. for three-phase short-circuits and 2 sec. for single- or two-phase short-circuits. If the short-circuit path contains considerable impedance the time constant is increased (not decreased, as one might at first assume), especially if the circuit is resistive. The reason for this is that as the power factor of the circuit increases the demagnetising ampere turns of the stator are thrown more and more out of phase in space with the main field ampere turns and thus become less effective in decreasing the main flux.

The short-circuit current of a transformer is limited by its leakage reactance, which is usually expressed as the percentage of the normal voltage that must be applied to one winding to cause the full load current to flow in the other winding, which is short-circuited. This value is susceptible of accurate measurement and may generally be given correct to within 5 per cent. The same remarks apply to the reactance of current-limiting choke coils.

Transmission Lines

Reactance and resistance of transmission lines and cables may be calculated with an accuracy of about 5 per cent. for the reactance and 2 per cent. for the resistance. Tables of values and methods of calculation are given for instance by Wilson.[1]

(*b*) *Method of Calculation.*—The author has given elsewhere[2]

[1] "Design and Calculation of Electrical Apparatus," Pitman, page 147.

[2] G.E.C. Journal, Feb., 1937.

a general résumé of the best-known methods of calculating short-circuits in networks. The only point which it is necessary to emphasise is the great importance, when dealing with low-voltage networks, of giving resistance the correct vector relationship with reactance. Resistance must be introduced into the calculations as soon as its total value for the circuit exceeds about 33 per cent. of the reactance.

(c) *Allowances and Corrections Especially Applicable to Low-voltage Networks.*—On low-voltage systems the direct component is usually so heavily damped that it may safely be neglected in calculating the current to be broken. The minimum total tripping time is seldom less than 0.15 sec. and more often 0.25 sec. If the time constant of the d.c. component is 0.1 sec. the d.c. falls at the end of 0.15 sec. to 25 per cent. of its original value, or at the end of 0.25 sec. to 7½ per cent. thereof. In most low-voltage systems the d.c. time constant would be less than 0.1 sec.; only in the case of a short-circuit on bus-bars fed directly by low-voltage generators would one expect to find any d.c. component remaining after the lapse of the time lag of the circuit breaker. Even so, however, it could be safely disregarded.

Taking Advantage of the Decrement

In the past it has been general practice to neglect the decrement of the alternating component of the short-circuit current and to choose a breaker capable of interrupting the initial instantaneous current. If the short-circuit current is considerably in excess of the combined normal full-load current of the alternators feeding the fault the decrement becomes quite appreciable at breaker time lags of 0.1 to 0.25 sec. As nowadays the ratings of circuit breakers are assigned with considerable accuracy (say, 10 per cent.), I can see no reason for failing to avail oneself of the easement consequent upon the decrement when choosing a circuit breaker for given conditions. The new edition of the German standard circuit-breaker specification, now being issued, specifically recommends that such allowance should be made.

Fig. 1 shows curves[3] of a suitable factor by which the short-circuit current calculated in the usual way may be multiplied.

To obtain the reduced value of the short-circuit kVA consequent upon the decrement of the a.c. component, calculate the instantaneous short-circuit (kVA_{sc}) and the full-load capacity (kVA_{fl}) of the system. From the ratio kVA_{sc}/kVA_{fl} and the appropriate curve for the time lag in question, find the value of k_1. The required value is then $kVA_{sc} \times k_1$.

In a conductor of large cross-section a.c. tends to flow more in the outside than in the inside layers due to skin effect. Similarly, when two conductors carry alternating currents between which a phase difference exists, as, for instance, two phases of three-phase bus-bars, the current tends to concentrate in those portions of each conductor which are in greatest proximity to the other conductor. This is called "proximity effect." The combined effect is to increase the apparent ohmic resistance of the conductor.

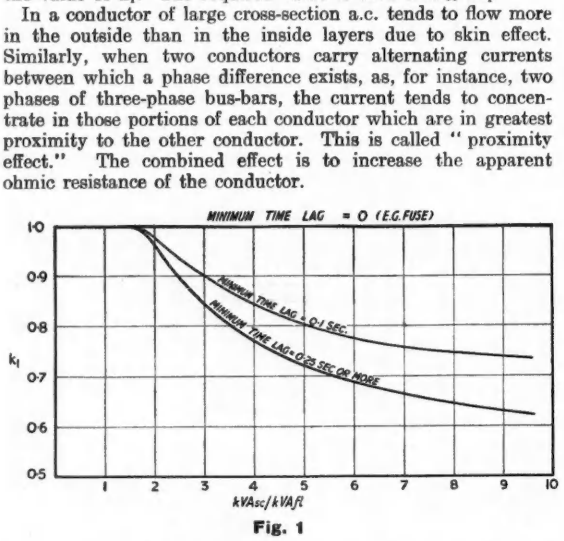


Fig. 1

This may be allowed for by replacing the calculated resistance by the so-called a.c. resistance. For practical purposes and on 50-cycle systems it is sufficiently accurate to increase the calculated resistance by 10 per cent. in the case of 0.4-sq. in. cable or solid conductors and by about 2 per cent. for similar conductors of 0.2-sq. in. cross-section. Complete tables of factors are given by Wilson.[4]

The voltage drop in arcs drawn between the contacts of a circuit breaker has been found to vary between about 30 and 40 V, which is equivalent to a line-to-line voltage $\sqrt{3}$ times as great, *i.e.*, of 50 to 70 V. This voltage drop is in phase with the current and its effect is equivalent to a reduction of the line voltage. It may conveniently be allowed for by multiplying the calculated value of the short-circuit current by a factor having the following values for different line voltages: 110 V, 0.55; 220 V, 0.73; 440 V, 0.84; 660 V, 0.9.

Joints, switch contacts and the like possess resistance of which it may be necessary to take account. Thus, a properly made joint will have about 4 millivolts and a switch contact about 12 millivolts drop at full load. Similarly, the inductance of loops or angles may also affect the value of the short-circuit current. A typical circuit breaker has a reactance (at 50 cycles) of the order of 0.0001 to 0.0002 ohms. The decision whether or not to include such stray resistances and reactances in the calculations must be made in each case upon its merits.

If the temperature rise of copper conductors is 100 deg. C., their resistance is increased by approximately 35 per cent. It is, however, seldom safe to make any allowance for such heating, as conductors are usually so liberally dimensioned that the temperature rise on short-circuit is small.

The making capacity of a circuit breaker must be sufficient to enable it to withstand the maximum peak current that can occur when it is closed upon an existing short-circuit. The peak current is greatest when the asymmetrical component is a maximum, *i.e.*, when the circuit is closed at a point upon the voltage wave corresponding to a current maximum, and occurs, therefore, half a cycle (0.01 sec.) after the contacts touch.

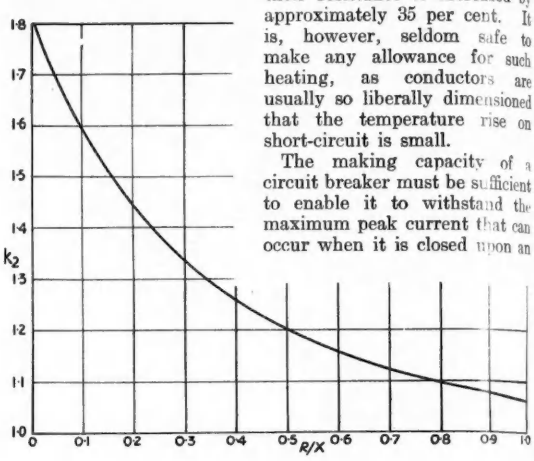


Fig. 2

If the decrement of both the alternating- and direct-current components of current were zero the maximum peak value of the making current would be twice the peak value of the alternating component. The effect of the two decrements, however, is to reduce the maximum peak current with terminal short-circuits to about 1.8 times the peak value of the a.c. component or 2.55 times its r.m.s. value.

If the decrement of the d.c. component is increased by the presence of resistance in the short-circuit path the factor by which the a.c. must be multiplied to obtain the making current is very much reduced. The appropriate value of the factor is shown by fig. 2 as a function of the ratio of resistance to reactance of the circuit.[5]

To find the making current corresponding to a given instantaneous short-circuit, kVA_{sc}, obtain the instantaneous a.c. component I_{sc} from $kVA_{sc}/\sqrt{3}$ kV (for a three-phase system) where kV is the system voltage. Find the value of R/X, and from this obtain k_2. The required value is $\sqrt{2}\, k_2\, I_{sc}$.

In calculating the ratio R/X it is not safe to assume that there will be any voltage drops in the circuit due to arcing. If the short-circuit is due to metallic contact between the conductors sufficient time will probably not have elapsed for this to develop into an arc, and if the circuit breaker closes cleanly there should not be any appreciable arcing at the contacts. The resistances should, of course, be corrected for skin and proximity effects and stray resistance.

In order to compensate for voltage drop in cables and distribution lines and transformers it is common practice to increase the bus-bar voltage above the normal value. This results in a proportionate increase of the short-circuit current. It is, therefore, wise to add an allowance of, say, 10 per cent. to the calculated values of breaking and making current in order to take account of the increased voltage.

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[3] See the draft of the specification, "E.T.Z.," Vol. 58, 17.6.36, page 675.

[4] "Design and Calculation of Electrical Apparatus," Pitman, page 135.

[5] This curve is again taken from the draft VDE 0670/1937, *loc. cit.*

Synthetic Resins

Examinations in plastics have been arranged by the City and Guilds of London Institute in conjunction with the Plastics Institute. Courses of instruction will be held at the Borough Polytechnic, beginning on September 27th, under the supervision of Dr. E. C. Pickering. Classes are arranged for technical men without much chemical knowledge as well as for those with more specialised training.

Leakage Trip Design.

By T. C. Gilbert, A.M.I.E.E.

The principle of potential operation

RECENT articles in the technical Press have indicated that there is a considerable difference of opinion as to the right way to construct a leakage trip, and in seven samples bought and tested the current required to operate the trip varied from 18 to 66 mA, and the a.c. voltage across the coil from 8 to 31 V.

On the Continent earth leakage switches are not built to a definite standard, but as they all fall within a very small margin as regards coil impedance and other details these values can be reasonably assumed to have been found the best in practice, and they are now adopted by common consent. During the ten years or more since leakage trip protection became widespread very little change has taken place in the devices used.

In considering design we must first get rid of any ideas that we may hold concerning the *current* operation of these devices, concentrating upon the principle that a leakage switch should

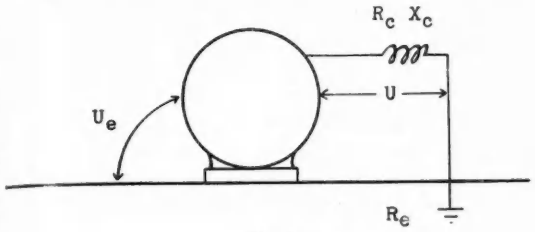


Fig. 1

be constructed to operate with a definite leakage *potential*. Taking 30 V as the limit—as recommended in the latest E.R.A. Report dealing with safety—the device must ensure isolation of any equipment the metal casing of which becomes charged to this value, against electrode resistances which may be as high as 300 ohms.

Taking the tripping voltage across the coil as U (fig. 1), the potential of the metal casing above earth can be shown as

$$U_e = U \sqrt{\frac{X_c^2 + (R_c + R_e)^2}{X_c^2 + R_c^2}}$$

where X_c and R_c are the reactance and resistance of the trip coil respectively, and R_e the resistance of the earth electrode.

Most Continental trip coils require a voltage (U) of 15 to operate the coil. If we construct the coil with a resistance of 200 ohms and a reactance of 200 ohms, we can plot a characteristic of our switch as shown in curve 1 of fig. 2, which shows that the switch will operate at 30 V, U_e, against an earth resistance R_e of 330 ohms. Such resistances are not difficult to obtain in practice, as even in sandy soil, with a specific resistance of 70,000 ohms per cm., a 6-ft. pipe should have a resistance of only about 340 ohms. The impedance of such a coil would be about 280 ohms, and would permit robust construction.

If we produce a coil with a resistance of 300 ohms and reactance 300 ohms, the result is shown in curve 2 of fig. 2. From this it will be seen that this switch will operate at 30 V, U_e, against an electrode resistance of 500 ohms, and the coil impedance would be about 420 ohms.

Trip-coil Impedance

These two examples show that the higher the trip-coil impedance the less is the dependence upon the earth electrode. It is a simple matter to build a leakage switch with a high-impedance coil which will permit operation at no more than 30 V against possible earth electrode resistances of three or four thousand ohms. In view of the small space available in the leakage switch, however, when trip coil impedances exceed about 500 ohms, the windings must be very fine and delicate. A trip coil with a winding of less than 28 or 30 s.w.g. is likely to have a short life under normal conditions of use, and most good quality German trips have coil impedances of from 300 to 400 ohms, certainly not above 500 ohms, with robust coil windings.

In addition to space considerations there is the important matter of insulation, especially at the coil ends. In rural areas, where most leakage switches are installed, delicate coils may be destroyed by lightning. The German coils have adequate insulation for the windings, thus preventing flash-over from the layer ends, and if the district is especially liable to lightning disturbances, then the coil is shunted with a gap, or possibly a non-inductive resistance. A delicate winding is never installed.

In addition, and possibly more important still, the full mains voltage to earth may have to be withstood in the event of a dead earth fault against a low electrode resistance, resulting in considerable damage to a delicate winding.

Robust coils can be constructed with coil impedances of between 300 and 400 ohms and, as fig. 2 shows, the switches will provide all the protection necessary against the highest electrode resistances likely to be met with in practice. Even if electrode resistances are in excess of 500 ohms the releasing voltage would not exceed 30 by an amount that would cause danger. The device must, at all costs, be reliable, and this cannot be ensured with very high impedance coils; the early devices manufactured in Germany suffered from the fault of over-stressing the need for independence of the earth electrode, and coils were constructed for operation with 10 or 15 mA only. The lesson was quickly learnt, however.

Present German requirements for leakage switches are that with 200 ohms in the earth circuit (earth electrode resistance) the switch shall operate at 22 V, plus or minus 2 V; with 800 ohms in the earth circuit, the switch shall operate at less than 65 V. The permissible voltage rise against high earth electrode resistance is thus considerably greater than the 30 V proposed for this country (which by no means represents universal agreement as yet), because isolation is so extremely rapid that 65 V is not considered dangerous.

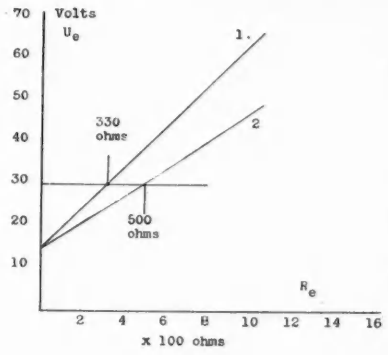


Fig. 2

Even with protective multiple earthing used in the Irish Free State the Electricity Supply Board utilises leakage switches, and has definite requirements for them. The tenth edition of the I.E.E. Wiring Regulations is used as standard in that country, but in Section 10 it is stated that where in this Section reference is made to an earth-leakage trip operating at 30 mA it shall be amended to read "An earth-leakage trip operating on a leakage voltage of 22 V, plus or minus 2 V, when the trip coil is in series with a resistance of 200 ohms and further operates with a test voltage of 30 V when the trip coil is in series with a resistance of 200 ohms, in at most 0.1 second."

Operating Time

Operating time is of major importance, and all German equipment operates within the time stipulated in the Irish regulation. It is to be hoped that this factor will not be lost sight of, if and when the overdue British Standard Specification is prepared for leakage switches manufactured in this country. Too rigid an adherence to the limit of safety proposed, 30 V, may lead us into difficulties, although not so serious as for the now discredited 30 mA requirement. Concentration on so low a figure is probably a relic of the days when isolation by means of solid earthing was a matter of time, and a sustained voltage of 30 is certainly to be avoided, especially where animals are concerned. If, however, isolation can be ensured in 0.1 sec., then much higher leakage voltages are permissible immediately before operation, at least where electrode resistances are excessive.

All German equipment is double, triple or four-pole, no single-pole equipment being used under any circumstances. The argument is that in rural areas the neutral is often a very live line, and as neutral potentials under fault conditions can be extended to connected equipment casings, the neutral should be isolated with the phase. In some German equipment the test key makes contact first to the phase and then to the neutral; it is not uncommon for the switch to operate on the neutral connection for test, indicating the presence of sufficient potential for this purpose.

Parallel Earths

A large body of opinion seems to favour a solid earth connection in parallel with a leakage trip on the ground that the best of both systems is thereby ensured. Parallel earths are not used in Germany or the Irish Free State, and are not even mentioned in the recent E.R.A. Report dealing with the leakage switch. Trips used under such conditions would have to be sensitive to low leakage voltages.

It is argued that should a fairly heavy current flow over the solid earth electrode, its resistance will cause a voltage to build

up on the appliance casing, thus operating the switch when the predetermined tripping voltage is reached. This argument is sound, provided that faults are dead to earth, or at least of extremely low resistance. Many earth faults, however, take place in the middle of coil windings or at some point of a heating element and possess considerable resistance, preventing the current building up to a high value. In the past, with solid earthing, it has been found impossible to isolate such faults, as the fault current was not sufficient to melt the fuse; this state of affairs is perpetuated with the solid earth connection in parallel with the trip earth. Thus, far from enjoying the blessings of both systems, we are merely retaining the bad points of the old, and high-resistance faults must burn themselves out to lower resistances before they can be isolated.

The first requirement is the prevention of dangerous potentials upon connected equipment, and here the fundamental difference between urban and rural conditions becomes apparent. In the town factory, a 1-A leakage on a motor eventually burns out and is isolated as a dead-earth fault; the resistance of the earth path is probably well below one ohm, and the voltage produced by the original leakage current is below one volt. The farmer's electrode, however, may possess a resistance of 50 ohms and the 1-A leakage produces a leakage potential of 50 V that is extended all over the place.

With simple series connection of the leakage trip, this potential will be isolated as soon as it appears; with a parallel earth in existence the electrode resistance may prevent the leakage

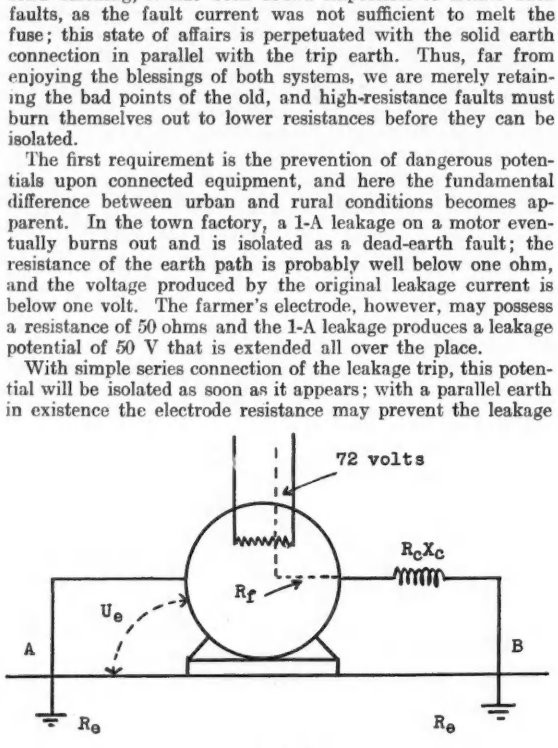


Fig. 3

current from growing to even 1 A. Without a heavy current, the parallel earth will not produce the potential necessary to operate the trip, unless trips respond to potentials of 3 or 4 V. The incipient fault is a menace in rural areas, as well as the dead earth fault. As an example, a farm motor may develop an earth fault, perhaps due to a nest of mice in the terminal box; in the early stages this fault will possess considerable resistance. In fig. 3 the fault is developing in a winding at a point that enables the fault to be fed at 72 V. Taking round figures we have 600 ohms as the fault resistance R_f, 200 ohms as the coil resistance R_c (reactance being neglected), and an electrode resistance R_e of 200 ohms.

Considering first the case with only the leakage switch earth, B, connected, the current flowing from the fault to earth, I, $=72/600+200+200=72$ mA, and the potential upon the motor frame $(U_e)=72/1{,}000(200+200)=29$ V. The switch will operate, as it requires only 22 V against an earth electrode resistance of 200 ohms.

If a second solid earth electrode is then connected in parallel with the trip, shown at A, then the overall resistance to earth, assuming 200 ohms for electrode A, becomes 133 ohms. This permits a current from the fault to earth of 98 mA, 65 passing down A and 33 down B; the potential upon the motor frame is only 13 V, however, and the trip will not operate although the current has increased by over 30 per cent. Keeping the 30 mA requirement in commission will not enable this particular fault to be cleared, as the trip coil is of higher impedance than 200 ohms, and the leakage potential must rise in proportion.

Test Difficulty

Among the other disadvantages of the parallel-earth method is the loss of easy test. The dual problem is to provide an earth connection that will afford protection—solid or trip—and then to ensure that all casings remain connected to that earth. This envisages some easy and certain test of the protective circuit.

The test key on the leakage switch itself provides an effective means with or without a parallel earth, of ensuring that the earth path between the switch and its electrode is intact, and that the mechanism is functioning. The most likely point of failure is, however, between the appliance and the leakage switch, often in the flexible cable or the three-pin socket. With simple series connection of the trip the phase terminal of the appliance can easily be shorted over to the earthed casing, when the switch will operate if everything is in order. Such a test becomes difficult or impossible with a second parallel earth, as should this be of low resistance fuses will be blown and possibly the equipment will be damaged.

With the leakage switch we have succeeded in getting the fuses out of the protective circuit, and we are now independent of them; it seems a pity to bring them back by installing a second parallel earth electrode which robs the leakage switch of half its benefit. Had we only to consider dead earths no great objection could be advanced against the parallel-earth method; but in the rural area the high-resistance fault must be isolated in its early stages if danger is to be avoided.

To my mind, only two arguments can be advanced in favour of the parallel solid earth. One, distrust of the leakage switch—that means the trip coil—and the second, the 30 mA leakages that take place from cooker hot-plates and are not shown with the parallel earth.

We do not want leakage switches to operate with 30 mA; 60 mA represents a much more useful current, and permits the use of robust coils with lower impedance, and if this were common practice switches would not operate unnecessarily when used with cookers.

If the passage of 30 mA does not give rise to dangerous potentials, the leakage may be allowed to continue, but if, due to high electrode resistance it produces a potential upon the cooker frame, something should be done about it as soon as this potential approaches the danger zone. To shunt a 30-mA trip by a solid earth defeats the whole purpose of the leakage switch.

In Germany the permissible leakage from hot-plates is 1.5 mA per kW of loading; the 750-W plate may pass 1 mA to earth. The result is that practically every cooker is protected by a simple series leakage switch, even in towns where earth resistances are negligible, but in this country we should not care to connect a 30-mA switch under such conditions.

If a high degree of selectivity is necessary, as when many leakage switches are utilised at one point for sub-circuit protection, the use of a lightly insulated protective wire—from the trip to the appliance and not from the trip to the electrode—is of advantage. In the ordinary way, however, insulation upon earth wires is unnecessary.

Qualifications of Electrical Salesmen

THE first examination in connection with the salesmanship courses instituted by the British Electrical Development Association is now in sight; it will probably be held in November.

The E.D.A. Council has defined the conditions of grant for the E.D.A. Salesmanship Certificate and the E.D.A. Diploma, and also the grades of electricity supply sales staffs eligible for candidature. The latter can be divided broadly into three sections:—

1. Canvassers and salesmen and saleswomen employed for routine house-to-house canvassing and as assistants in showrooms. The qualification for this class should be the E.D.A. Salesmanship Certificate.

2. Sales engineers, who should be competent not only in salesmanship but in service to consumers, and therefore should possess a certain standard of engineering knowledge. Their qualification should be the E.D.A. Diploma, the conditions for the award of this being as follows:—I. The securing of the E.D.A. Salesmanship Certificate with distinction. II. Engineering knowledge as attested by one of the following: (*a*) possession of the National Ordinary Certificate in electrical engineering; (*b*) the passing of Part I of the graduate examination of the I.E.E.; (*c*) the City and Guilds Electrician's Extra Certificate; or (*d*) the passing of any other examination of equal minimum standard approved by the E.D.A. Council. III. Viva voce examination by an examiner appointed by the Association. IV. Testimonial from the chief engineer and/or manager of an undertaking in which the candidate is, or has been, employed, in the form of answers to a questionnaire.

Until December 31st, 1938, sales engineers who have occupied a position of responsibility in the supply industry for not less than five years continuously may be exempted from II if a panel of examiners appointed by the Council is satisfied from information submitted as to the candidate's engineering knowledge.

3. With regard to women demonstrators, the E.A.W. Training and Diploma Committee is to consider a suggestion that in future the E.A.W. Diploma shall not be granted unless the applicant already holds the E.D.A. Salesmanship Certificate.

Motors, Welders and Trucks

A variety of activities at a Walthamstow works

SINCE our last visit the Walthamstow works of the Fuller Electrical and Manufacturing Co., Ltd., has changed completely in outward appearance. The new year commenced with the removal of the administrative and commercial staff into a newly built block of lofty offices, the third floor of which is a liberally equipped canteen. A folding partition enables the staff and workers' dining-rooms to be converted into a spacious recreation hall, while the kitchen contains Benham cooking appliances (mostly electric) and a six-compartment Kelvinator refrigerator. A fume-extracting canopy incorporating a motor-driven exhaust fan has been built into the glazed roof directly over the central range of electric ovens, on top of which stands a series of gas rings.

Behind the office block is the single-storey factory, in two sections. The newer is devoted to the manufacture of motors, thus freeing the older portion for the production of transformers and on-load ratio-changing equipment, as previously described. Part of this shop is just now occupied with the assembly of circuit-breakers for the Southern Railway, while the testing section has had to be enlarged by encroachment upon what formerly was the works sub-station. In its place a new two-storey structure has been built specially to accommodate three-unit motor-generator sets for testing, while above new circuit-breakers and control gear have been installed.

Excavation commenced recently for the foundations of a sand-blasting shop which is to be added, and the ground is being levelled for the longitudinal extension of the three bays now occupied with manufacture of a range of a.c. motors for single-, two- and three-phase circuits, slip-ring and squirrel-cage types. They are assembled on a roller conveyor incorporating drying and baking ovens, so facilitating short-delivery service, additionally to the stock of completed machines individually wrapped in paper for storage.

Interchangeable end-brackets fitted with dust-proof ball and roller bearings provide for the substitution of any sort of cover, including open-protected, drip-proof, pipe-ventilated, or total enclosure. Mechanically interchangeable d.c. motors are also available in the smaller frame sizes, but the declining use of d.c. is focusing attention on to variable-speed a.c. motors, for many years a speciality of the Fuller Co.

These a.c. commutator motors are made in sizes from under 2 h.p. to 600 h.p. with a variety of enclosures. They are constructed according to the Schrage system, combining the characteristics of shunt regulation with capability of speed adjustment quite independently of load variation.

The normally unsymmetrical brush-gear can be specially arranged to permit the reversal of the direction of rotation. The primary winding is in the rotor and is brought out to slip-rings while the secondary winding is in the stator. The rotor also carries a regulating winding brought out to a commutator on which the brushes are held by two rocker arms which can be rotated relatively to one another.

The new administrative block

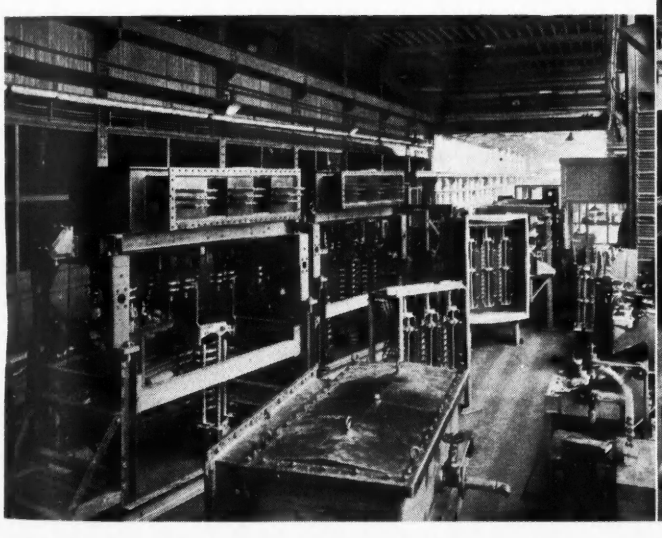
Geared units are available for single, double and triple reductions, providing speeds of from 18 to 4,800 r.p.m. The stator of a standard motor is bolted direct on to the gear housing, which it overhangs. Fine pitch helical gears are used throughout.

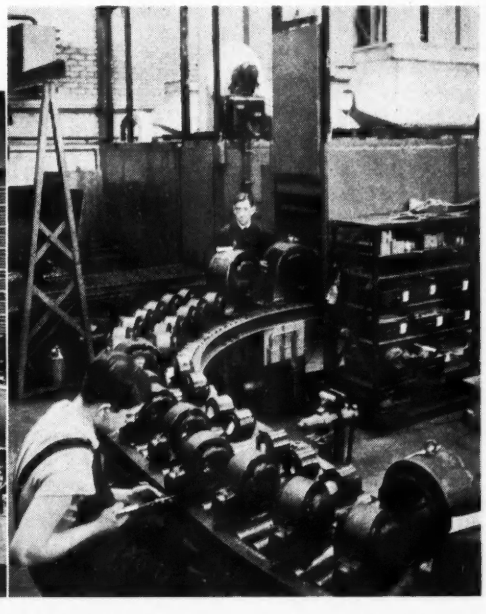
In addition, the Fuller-Asea concern is an agent for the "Century" single-phase repulsion-start induction motor, which is made in very large numbers in America, in sizes of from ½ to 40 h.p. for frequencies between 25 and 100 cycles. This type combines the characteristic of a repulsion motor during starting with that of an induction motor when running. While in the repulsion sense the motor is capable of exerting a starting torque of not less than 350 per cent. of the full-load torque with a momentary starting current of the order of 260 per cent. of the full load current. When the motor reaches approximately 80 per cent. of its full-load speed a centrifugal governor short-circuits the commutator and lifts the spring tension off the brushes, converting the motor into a simple squirrel-cage single-phase motor.

An interesting development of the Century Company is its automatic-start polyphase induction motor. This motor develops a high starting torque approximately 2¼ times the normal torque, taking only 2½ times the normal current momentarily when thrown upon the line; it is very suitable for automatically controlled air and refrigerator compressors. The high torque characteristic is provided by a double-wound rotor. The high-resistance squirrel-cage winding is in circuit both during starting and while running. The low-resistance winding is not in circuit during the starting period, but is introduced by a governor-operated short-circuiting device when the motor has reached from 70 to 80 per cent. of its full-load speed. This type AS motor is manufactured in a number of sizes between ½ h.p. and 50 h.p. for 50-cycle circuits.

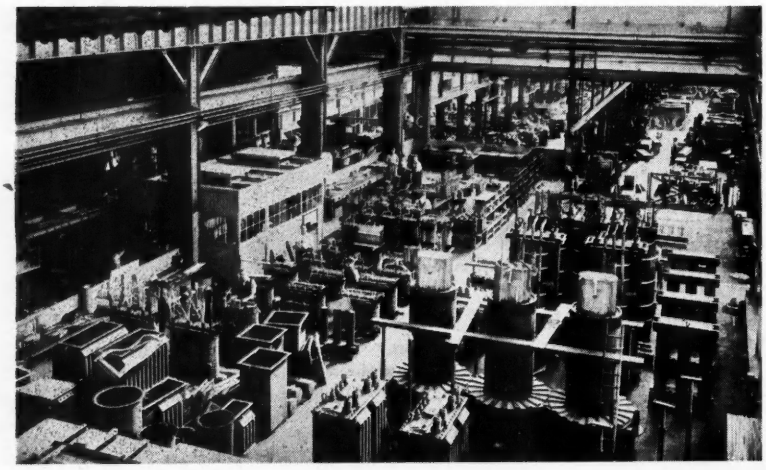
For metallic and carbon-arc welding a range of motor-generator sets is made for various outputs from 15 to 600 A, and for both d.c. and a.c. inputs, with or without trucks.

Below is a view of part of the large switch and transformer shop, and to the right motors are being assembled on a roller conveyor passing through drying ovens





They are self-stabilising, with drooping characteristics, the smaller machines being self excited and the larger ones having separate overhung exciters. The output current is adjustable by means of brush-shifting or series field tappings and shunt regulation, combined with a "quick voltage recovery" field system that ensures rapid voltage response. By this means the welding current is adjustable in steps of 5 to 10 A.



Part view of transformer building bay at Walthamstow

The carbo-flux process consists of electric arc welding by means of a carbon electrode fixed in a special holder that is made negative relative to the object being welded. This process is applicable to sheet iron, mild steel and stainless-steel plates (22 to 10 gauge) with butt, outside corner, lap, or edged joints. Special fluxes are necessary, which are painted on the seam prior to welding by hand, or automatically in the case of thin sheet-metal vessels. For longitudinal seams there is a semi-automatic head on a motor-driven carriage that travels along an angle-iron track, appropriate gearing providing different welding speeds. For circular welds in cylindrical tanks a stationary head is employed in conjunction with work-rotating mechanism, with push-button contactor control in all cases.

Transformer-type spot- and seam-welders are of the "controlled" design, the pressure of the water-cooled electrodes being applied by a spring actuated by a foot pedal which also automatically operates the switch. Truck-type and pendent models are fitted with pneumatic electrode pincers. Motor-driven machines have mechanised time switches, and for very high-speed welding a cathode-tube timer can be fitted for current interruption up to 1,500 times per minute.

Welders can be designed for electrode pressures up to five tons. An energy control device is available for motor-operated spot-welders, which ensures constant heat absorption at the weld independently of the varying condition of the surface (scaled or unclean stock). It also eliminates the necessity of adjusting the welding current by means of the selector switch to compensate for excessive changes of impedance in the secondary circuit due to the position and size of stock being welded. A range of metallic electrodes is supplied.

Other Products

In association with A.S.E.A. Electric, Ltd., electric hoists specially designed for alternating current, three-phase, can be supplied to lift from 2½ cwt. to 10 tons. One of them has been utilised as a coal telpher at the Walthamstow works. Pendent push-button switches are the standard method of operation and afford extra-fine control of both hoisting and travelling motors, including "inching" and speeds down to one-fifteenth of normal. Both travelling and hoisting motor brakes are automatic and released through the agency of the magnetic field of the motor stator. The load is equalised on twin-rope drums, apart from which all moving parts are totally enclosed and self-lubricating.

Battery-operated A.S.E.A. trucks of from 1 to 15 tons capacity can be designed for most industrial requirements, and may be fitted with cranes, elevating platforms, &c., actuated by separate motors directly coupled to the driving axles. Special designs of truck include one incorporating a weighing machine in the platform; a cable drum truck which has six wheels, all of which steer for easy manœuvring; while a truck driven by two motors in series-parallel is made to run on rail track for heavy engineering works.

For correcting power factor static condensers are built up of multiple layers of paper and aluminium foil placed in sheet-steel containers. They are vacuum-dried before impregnation and then hermetically sealed. The smaller sizes are in single tanks, large capacities being built up of batteries of single-phase elements, which are connected in delta for three-phase and in star for the higher voltages.

The Smaller Supply Undertakings

A MEETING of the Executive Committee of Smaller Municipal Electricity Supply Undertakings was held in Manchester on September 15th, representatives from all parts of the country attending. The Committee gave careful consideration to the position in view of information which had been received from a reliable source to the effect that it was the intention of the Government to drop the proposals outlined in the "White Paper" and introduce a Bill in the next session of Parliament based on the recommendations in the McGowan Report.

It was decided that the most strenuous opposition by every legitimate means should be offered to any proposals for the compulsory amalgamation or transfer of efficient undertakings from the local authorities to any other body, with consequent loss of identity. Statistics were produced to show that the smaller undertakings, in spite of the severe handicap of being called upon by the Central Electricity Board to pay considerably higher prices than the large undertakings for their bulk supplies, were offering, on an average, tariffs very little higher, and in many instances considerably lower, than the large undertakings, and also giving equally good service to their consumers.

It was considered that one of the first essentials for the rendering of prompt and efficient service to the consumer was the personal touch of the "man on the spot" who knew the local conditions which varied so widely in residential, industrial and rural areas in different parts of the country. If control were exercised from some distant point out of touch with local conditions, the inevitable result would be red-tape and delay in settling trifling matters, causing much annoyance and dissatisfaction to the consumer.

It was agreed that every local authority should be requested to get into touch with its local Member of Parliament, with a view to making clear the uncompromising hostility which existed throughout the country to any proposals for taking the control of local electricity supply undertakings completely out of the hands of local authorities, also to prepare plans for the holding of protest meetings and demonstrations throughout the country in the event of legislation on these lines being introduced, as it was considered that the objects of the McGowan Report could be better achieved, and electrical development accelerated to a far greater extent by retaining the local interest and allowing local authorities to keep their undertakings and have at least a similar measure of control to that at present exercised by them over other public services.

Finally, it was decided that a letter should be sent to the Minister of Transport asking him to receive a deputation which would place before him the views of the organisation.

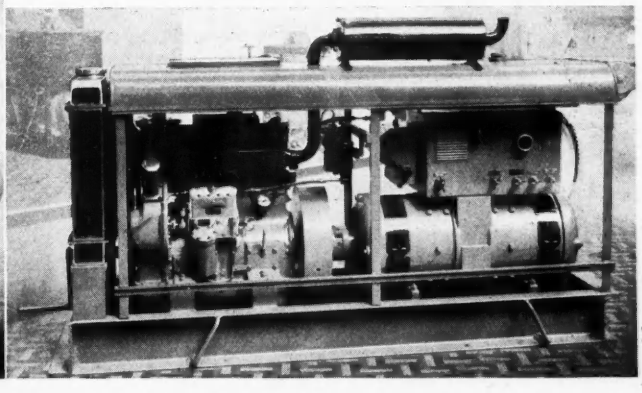
The "Model Engineer" Exhibition

The ever-increasing influence of electricity in our lives is reflected in a large proportion of the displays at this year's *Model Engineer* Exhibition now being held at the Horticultural Hall, Westminster. Not only are most of the working models electrically operated, but there appears to be a growing tendency to make models of electrical equipment. An outstanding example of patience and ingenuity is a ¼-in. cube electric motor, other notable exhibits being a scale model of an electrically operated 35-ton coaling crane and an eight-plate Wimshurst machine. Train and ship exhibits, always a strong feature, include an electric locomotive with series-parallel control and automatic overload protection, a working model of electric traction control and signalling equipment, an electric patrol launch and an electrically driven model of the *Girl Pat*. Among the trade displays are a working exhibit showing the application of Chloride batteries for operating models; power units, relays and electric railway accessories (Shenphone Electrical Products); adjustable lighting units (Mek-Elek Engineering, Ltd.); and various tools, castings and other engineering requisites. The exhibition closes to-morrow (Saturday).

Modern Welding Equipment

Some details of the equipment on view at Olympia

THE biennial Engineering and Marine Exhibition which is now running at Olympia (September 16th to October 2nd) changes very little in character, but its title has been altered (hitherto Shipping, Engineering and Machinery) to more intimately relate it to the industries which it seeks to serve.



Left: Mawdsley's single-operator generator set with barretter (valve) control to prevent excessive voltage. Right: Murex Diesel driven welding outfit with double dynamo of the single-carcase type. The control gear is mounted upon the dynamo *[Elec. Rev. photos*

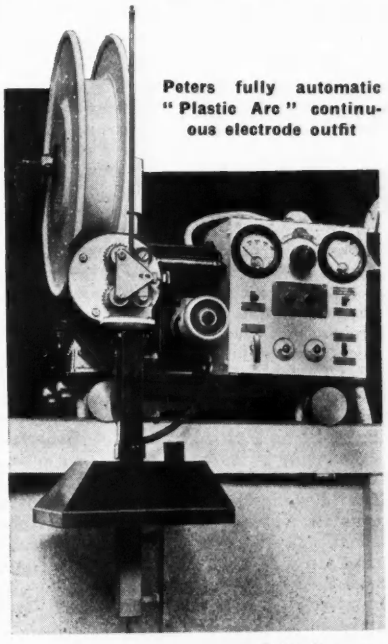
The present display is the fourteenth of the series, which commenced in 1906, and is really three distinct shows, each germane to the original exhibition, yet each catering for its own specialised technicians. Foundry exhibits were first incorporated in 1935 and have been repeated, while this year a special effort has been made to get together a section devoted to the several branches of welding. Mr. C. G. Bainbridge (British Oxygen Co., Ltd.) is the chairman of the Welding Exhibition Committee.

This is probably the first occasion on which a concerted display of welding plant has been attempted on a large scale, though the exhibits are not all electric, of course, since the new section includes some gas welding appliances and the flame cutting machines now being increasingly used as preparatory tools for welded fabrication in substitution for casting.

Automatic actuation of welders is becoming prominent and electrical control is being applied with increasing precision, with the aid of thermionic valve regulators. Machines for the butt welding of wires made of steel, copper, aluminium and other alloys are a speciality of the Selson Machine Tool Co., Ltd. One of the models on view is capable of handling wire finer than 0.01 in. in diameter.

A change is becoming evident in engine-driven sets. Hitherto they have almost invariably been of the petrol type, whereas Murex Welding Processes, Ltd., now offer arc welding plant driven by Perkins "Wolf" Diesel engines. A double dynamo of the single-carcase type with a drooping characteristic is employed; and a special paralleling and equalising switch is fitted for extending the current range, the control gear being accommodated in an over structure on top of the dynamo. Single-operator sets are driven by Lister oil engines, while the power factor of transformer sets is improved by the incorporation of static condensers.

Electrode design has tended toward the provision of higher welding speeds by increasing the rate of metal deposition, but the attainment of this object is apt to restrict the applicability of an electrode in the horizontal plane. The user has therefore to choose between the many "single purpose" types of electrode available for particular classes of work, or, alternatively, to select a general-purpose type of good average performance. On the Murex stand are some excellent examples of "overhead" deposition, while the structural steel work for this company's new factory at Waltham Cross is being welded throughout, including the roof supports and girders with a 125-ft. span for three 500-ft. bays.



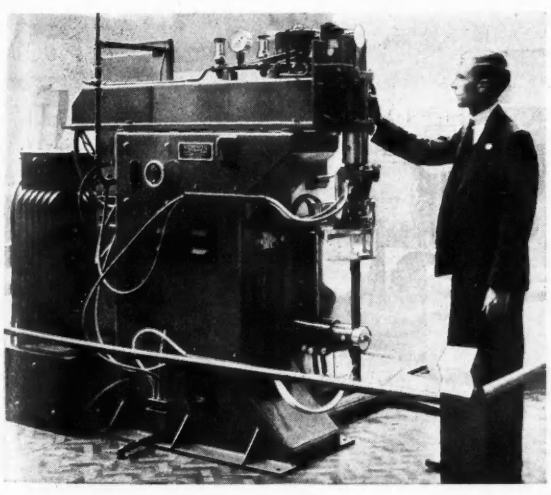
Peters fully automatic "Plastic Arc" continuous electrode outfit

[Elec. Rev. photo.

Rods and fluxes for welding at low temperatures are displayed by Fred. Burris & Sons, Ltd. The range of electrodes offered by Rockweld, Ltd., includes types for welding stainless steel and non-ferrous metals; the company also displays single-phase air-cooled transformer sets. Apart from transformer welders so arranged as to be suitable for six different input voltages, Invicta Electrodes, Ltd., are featuring new electrodes intended for reinforcing cutting tools, dies and other parts subject to wear. Great hardness is claimed for "Ardentuf," yet its toughness is said to avoid brittleness.

The stand of the Quasi-Arc Co., Ltd., is in the nature of an information bureau with descriptive photographs and drawings illustrative of the varied work undertaken. Examples of welded construction as applied to heavy engineering parts by Dorman, Long & Co., Ltd., and Babcock & Wilcox, Ltd., are also on view.

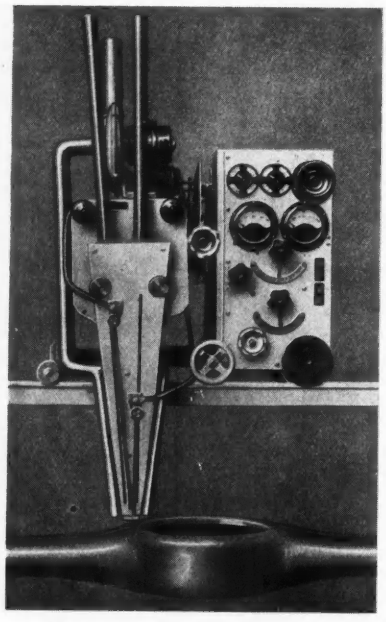
A wide range of electrodes is offered by the Metropolitan-Vickers Electrical Co., Ltd., whose a.c. equipments are shown, together with special variable reactances. There is a high-frequency rotary set designed for thin plate welding,



[Elec. Rev. photo.

"Metrovick" light alloy spot welder with valve control

examples of the atomic hydrogen process and an automatic head for use with fully covered electrodes. The "Paradyne" d.c. sets are claimed to have a particularly rapid voltage recovery, but the latest M.V. product is a spot welder of the resistance type of 350-kVA capacity specially made for welding aluminium alloys as used in aircraft construction. These materials, which are usually "heat treatable," have fairly high electrical conductivity and for this reason it is necessary to take special steps in the construction of spot welding machines in order to ensure uniformity and high strength welds.



Kjellberg automatic welding head and controller

The control of very heavy currents of short duration cannot be satisfactorily carried out by means of a mechanical device which has considerable inertia. The control of this machine is by means of thyratron valves with which it is possible to start the flow of current at a predetermined point in a cycle and to accurately time the weld down to a minimum of one cycle on the 50-cycle supply. By this means, and by suitably arranging the mechanical parts of the machine, the satisfactory welding of such materials as "Alclad" and "Dural" has been made possible.

One of the items shown by G. D. Peters & Co., Ltd., is automatic "Plastic Arc" plant designed for continuous feed welding with coated electrodes of any type in straight lengths. The electrodes are joined by means of small connectors made of a special material which does not affect the physical properties of the weld metal. These connectors also serve as the means of introducing the welding current to the electrodes. Clutches are not employed in the arc control system, which is claimed to be so steady that the electrode has no tendency to "pump," while care has been exercised to reduce the inertia of all moving parts as much as possible.

Tandem sets with single yokes are built by Mawdsley's, Ltd., who also offer a welder intended for permanent installation in ships to serve as a "tool" for work to be done at sea or in foreign ports where suitable plant may not otherwise be available. Transportable outfits are now fitted with a barretter valve (which displaces the field regulator) to limit excess voltage when the machine is cold and avoid overloading. With this device a simple controller suffices, in the form of a stabilising resistance, all steps being of equal value.

Simplicity is the key-note of this company's "A.D.C." system. The generator is level compounded to provide a constant low voltage for welding. From two slip-rings connected to the armature winding low voltage a.c. is taken to a primary coil wound over the usual welding reactance winding. Thus, in effect, an a.c. voltage is superimposed on the d.c. generator output, so providing the requisite extra arc-striking voltage. Immediately the arc has been struck the a.c. circuit is automatically broken, leaving the lower d.c. welding voltage alone; this is done equally simply.

In every welding reactance an air gap is provided in the magnetic circuit to avoid saturation of the iron. Instead of using a solenoid coil to actuate the contactor, the magnetic leakage across the air gap is utilised to attract an iron armature, so breaking the a.c. circuit. Whenever the operator stops welding the consequent diminution of magnetic leakage releases the armature which is then forced to re-establish contact by a compression spring, thus restoring the striking voltage.

Any number of operators can be supplied from the same "A.D.C." generator, each man being provided with a combined transformer-reactance-contactor unit. Any make of electrode may be employed and extra heavy current is obtainable by utilising two or more circuits to feed one operator; alternatively, some circuits can be used for heavy welding while others remain suitable for medium operation and, in addition, such subsidiary devices as electric grinders or drills may be driven from the "A.D.C." set without interfering with welding simultaneously carried on.

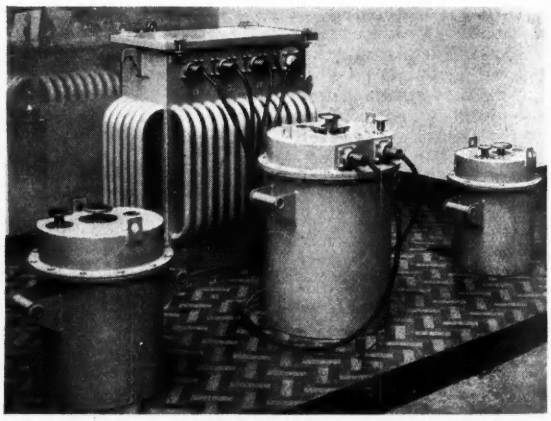
A welding process which enables chemical vessels to be lined with lead by deposition, which results in remarkably uniform thickness due to plastic flow and necessitates little subsequent trimming, is featured by Welding Supplies, Ltd. This company is also demonstrating the Kjellberg (Swedish) automatic welder. Different operations are catered for by easily interchangeable welding heads mounted on a travelling carriage. This is motor driven either along guide rails, or, in some cases, directly on the structure to be welded. There are two electrode holders, one moving downward as the empty one rises, thus permitting replenishment without interrupting the arc. A pendulum movement can be provided to enable wide beads of weld metal to be deposited.

Also mounted on the travelling carriage is a motor fan for removing fumes, together with an instrument and control panel. From the latter multiple cables pass to the motor generator set, which is remotely regulated through the agency of three miniature generators driven in tandem by a small motor supported on top of the main machine.

Transformer outfits are demonstrated by the English Electric Co., Ltd., with multiple outlets for separate oil-immersed regulators for individual operators up to twelve. A switch in the cover of each permits the selection of current values to suit different electrodes, as many as thirty-six steps being provided. Four sizes of transportable sets are available, a single oil tank housing both regulator and transformer. There is light gauge equipment for tinsmiths and sheet-metal workers, and also an auxiliary controller for attachment in series with the main regulator to reduce the current for very thin metal work.

A pedal-operated spot welder of the British Federal Welder and Machine Co., Ltd., embodies "Stronghold" automatic current control gear. A stitch welder is driven by a three-phase motor at the rear through a camshaft and mechanical clutch controlled by a foot lever; it can make up to 180 spot welds per minute. A percussion welder of American design is controlled entirely electrically, either by thyratron valve or ignition control.

A range of low-voltage spot, butt, flash-butt and rivet heating machines represent Holden & Hunt's latest designs, models made specially for welding wire being also made. Heating speed and weld timing controllers can be fitted, together with a simple cut-out switch for use when plain operation is desired. The exhibit of J. H. Holmes & Co., Ltd., is a single frame a.c. motor-generator set. It is completely metal clad



"English Electric" multi-controller transformer welder

and the two shunt field windings are so arranged that a separate exciter is not needed, a steady arc being ensured without the use of choke coils.

A detachable control unit for use at a distance is provided with the "Universal" transformer welder of Petbow, Ltd. (incorporating Agile Electrodes, Ltd., and Weldrics (1922), Ltd.), which is made suitable for connection to almost any source of a.c. This concern's rotary sets have flange-mounted driving motors.

Among the large machines displayed by Soag Machine Tools, Ltd., are automatic seam, spot and stitch welders with arms of great length for accommodating awkwardly shaped parts, such as are met with in coach work. All actuating gear is conveniently grouped, the driving motor being switched by press button and a pedal contact raises and lowers the upper electrode arm.

In the range of arc and resistance welding machines of the Fuller Electrical and Manufacturing Co., Ltd. (associated with Asea Electric, Ltd.), are both motor-generator and trans-

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Accidents—the Neglected Factor

The latest report on electricity in collieries by H.M. Inspector of Mines is not a much more cheerful document than its predecessors. Taken along with the corresponding reports on electrical accidents in factories and on industrial accidents in general it suggests that we have got somewhere near the limit of the improvement that can be effected by the regulation of machinery. More stringent regulations and more extensive and intensive inspection may reduce the accident rate a little, but it is difficult to see how, by this means alone, we can effect a material reduction in the number of accidents.

In nearly all their reports the various inspectors give a clue to another form of treatment—without following it up. For example, the Inspector of Mines, discussing certain purely electrical accidents, submits that "all these accidents . . . could have been avoided either by greater care on the part of the individual or by more effective supervision." No method of dealing with this sort of carelessness is, however, suggested, but it may be surmised that the Inspector, if he had anything specific in mind, would propose to apply some sort of penalty. In the 1935 report on electrical accidents in factories the Electrical Inspector significantly observes that "'Mistake' is frequently advanced as a *satisfactory* explanation, but many so-called mistakes really involve neglect and need not have occurred with proper care. Some of these cases have been followed by legal proceedings."

It is altogether proper, no doubt, that legal action should be taken in cases of gross carelessness. But the preventive effect of this policy is, at its best, rather of a *post mortem* character, and it does not touch the numerous cases where accidents are caused by absent-mindedness, error of judgment, or some other temporary lapse which cannot be classed as criminal negligence. We have done a great deal to control machinery in relation to accident risk, but apart from admonitions of the "Don't do this" and "Don't do that" type we have left men for the most part to look after themselves.

The time has come, therefore, to see whether we cannot apply the instrument of research to the human causation of accidents. A few promising beginnings have already been made in this field by the Industrial Health Research Board and the National Institute of Industrial Psychology. It has been found that "accident proneness" is a characteristic of a minority of workers; also that this weakness can be detected, in advance of employment, by sensori-motor tests. Further, there is a causal relation between aptitude for particular work and freedom (comparatively speaking) from accidents. An experiment carried out by the N.I.I.P. on 140 learners (in the textile industry) showed that those who failed to reach a certain standard of dexterity in training sustained on the average twice as many accidents as those who became proficient.

These investigations were, of course, limited in scope and the results are not necessarily applicable without modification to other occupations. Nevertheless, they demonstrate the possibility of getting a grip on the human factor in accidents. Preliminary tests adapted to the particular occupation in view will eliminate the accident-prone in respect of that occupation and also, perhaps, indicate the type of work for which, by reason of its low accident risk or other features, the men rejected are better suited. If this selection is followed by a systematic course of training, based on an analysis of the operations involved in the work and conducted on systematic lines, it makes correct—and therefore safe—methods of working habitual from the start.

Another point of importance is that men who are well adapted to their job are more stable and more comfortable than misfits and therefore less liable to accident. Unsatisfactory working conditions—including bad lighting, inadequate heating and inefficient ventilation—also have a bearing on the accident rate. All these aspects of the problem call for further research, and it is to be hoped that the various Departments concerned in measures for accident reduction will carry their examination of the human factor a great deal further.

September 20th. PROTONIUS.

Standardised Cartridge Fuses

With reference to the letter from Mr. E. S. Weeks appearing in your issue of September 10th under the above heading, we wish to point out that while the name of the writer of the letter may be confused with the name of this firm, there is no connection whatever between them.

This firm has tried to keep the sizes of its cartridge fuses standardised, but as customers' requirements vary so much, this has not been possible. It appears that cartridge fuses are used in such varying sizes and designs of apparatus that even the British Standards Institution has not been able to specify dimensions in its latest specification B.S.S. 88—1937.

With regard to the replacement of cartridge fuses, we would state that for all usual sizes manufactured by us we can supply reasonable quantities of replacements, for delivery by return of post.

L. WEEKES (LUTON), LTD.
T. H. Dryden, *Governing Director.*

Luton, *September 20th.*

An All-electric Organ

Replying to the letter of Mr. K. H. Davolls in your issue of September 10th, I would like to say that in a purely descriptive article of restricted length it is impossible to deal really fully with any one phase of the constructon of such a complicated instrument, and it is a fact that certain fundamental requirements of electric organ building were passed over.

It must be clear that in order to generate the 91 frequencies referred to in the article the discs must either be driven at different speeds or be provided with a different number of teeth or "high spots." In practice, in order to keep the number of different discs down to a minimum, a combination of these methods is employed, and some gearing is introduced, as suggested by Mr. Davolls, but whereas he shows that from consideration of the "obvious" twelve sections or sub-divisions of the generator shaft would be *necessary* (one per each note of the octave) nearly 50 sections are actually employed, each isolated between a pair of steel shields or screens to minimise magnetic interaction.

I think the idea behind my remark, "The wheels are grouped according to frequencies and their multiples," which Mr. Davolls quotes, would be more accurately expressed if written "according to frequencies and certain of their multiples" since a special system of grouping is definitely employed.

Ruislip, *September 21st.* C. MCKECHNIE JARVIS.

Modern Welding Equipment (*Continued from previous page*)

former sets. Foot-operated, motor-actuated and automatic models are available, to which further reference is made elsewhere in this issue, and demonstrations of the "Carbo-flux" process of arc welding light sheet metal and stainless steel can be witnessed.

Beside electrodes for manual use the Fusarc Welding Co. supplies automatic welders and the semi-automatic "Pistol-arc" device, both of which employ continuous electrodes. Transformer sets are fitted with condensers if desired, and a tensiometer is available for determining stresses set up in structures by the process of welding. Tensometer, Ltd., not only furnishes measuring devices but also tools for making test pieces quickly and cheaply. A new pneumatic conversion set is shown by New Process Welders, Ltd., for spot welders; pedal-operated, motor-driven and transportable models are on view; also a Heubach "Ferroscope-Ferroflux" magnetic crack-detecting outfit of the bench pattern utilising the "iron filings in oil" method.

A mobile X-ray unit for the visual examination of welded joints and castings shown by Philips Industrial, Ltd., has a continuous rating of 20 mA at 150 kV; the tube is water-cooled and all controls are fully interlocked. Thermionic rectifiers are being demonstrated, including the latest "metal" valve, which is capable of passing up to 75 A; it is constructed of chrome-iron and glass, being only 10 in. long and water-cooled. It will carry considerable overloads and current surges are not detrimental to it. There are timing relay tubes for limiting the current flow of spot welders to, say, five cycles, or one-tenth of a second. Condensers are also on view.

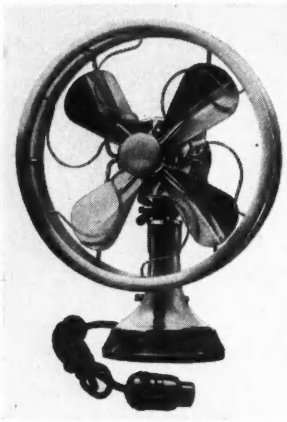
A desk-pattern transformer welder incorporating impedance control is offered by Equipments, Ltd., beside acetylene generators. A substitute for this gas is the "Pyrogas" of the Saturn Oxygen Co., Ltd., while flame cutters for shaping material prior to fabrication by welding are often motor-driven and electrically controlled. Equipment for this purpose is exhibited by the British Oxygen Co., Ltd. (also metal spraying plant), Thorn & Hoddle, Ltd., C. S. Milne & Co., Ltd., and Hancock & Co. (Engineers), Ltd., further information being available on the stands of British Industrial Gases, Ltd., the British Acetylene Association and the Institute of Welding.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Electric Fan

The new Ormond fan (ORMOND ENGINEERING CO., LTD., Rosebery Avenue, London, E.C.1), has the outer edge of the guard and the pedestal moulded, while both the motor housing and the fan blades are chromium plated. There is a push-bar "on-off" switch in the pedestal. By means of a thumbscrew adjustment the fan can be tilted to any angle. The motor is of the universal type and can be supplied for 100-115, 200-220 or 230-250 V. A combined two-pin plug and lampholder adaptor is fitted.



The Ormond fan

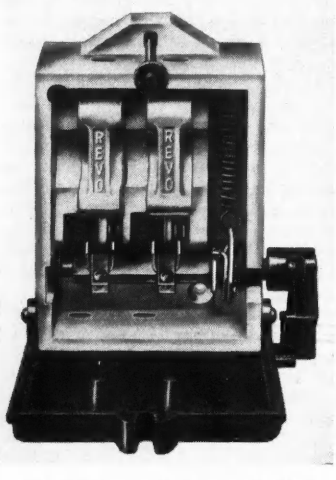
Clocks in Colours

We are informed that SMITE'S ENGLISH CLOCKS, LTD., Cricklewood Works, London, N.W.2, are introducing a range of electric clocks in pastel colours, styled to tone with any decorative scheme. In addition, the wall clocks "Durban" and "Dulwich," the alarm clocks "Lark" and "Callboy," and the mantel clock "Perth" will be available in blue, green and primrose.

Domestic Switch-Fuses

A new cooker control panel and an all-insulated switch-fuse have recently been introduced by the REVO ELECTRIC CO., LTD., Tipton, Staffs.

The control panel is made in 5- and 15-A sizes, and a removable panel enables the fuse to be rewired or the lamp renewed without the case being opened and the terminals and wiring exposed. The main 30-A d.p. switch employs q.m. and b. action. All current-carrying parts are of high-conductivity bronze and copper, and all moving parts are easily replaceable without dismantling the units. The secondary circuit comprises a 3-pin 5- or 15-A B.S.S. "anti-flash" plug and socket controlled by a substantial d.p. switch. The complete circuit is fully protected by a s.p. fuse and complies with British Standard Specification No. 438. A clearly marked indicator which operates with the switch gives "on" and "off" positions, and this, together with the pilot lamp, if used, provides double indication.



The Revo all-insulated switch-fuse

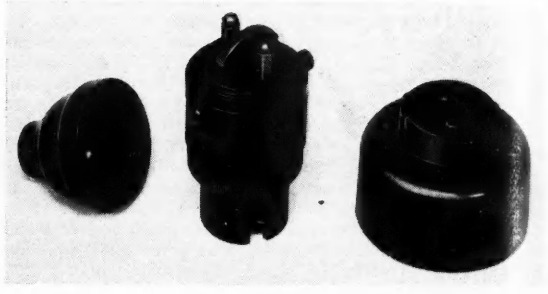
The all-insulated 15-A switch-fuse is for house service installations where tough-rubber cable is used. A standard q.m. and b. switch is incorporated and fitted into a vitreous china base, which also houses the contacts for the fuses. The hinged bakelite cover incorporates an interlocking arrangement conforming with Home Office requirements, and ample room is allowed for wiring. The locking nut can be sealed.

The switch-fuse measures 5 in. by 4½ in. by 2¼ in., and the cooker control panel 6¾ in. by 6½ in. by 4 in.

Small Accessories

Among the accessories which have recently made their appearance is a lampholder by A. J. ANDREWS, LTD., Gamage Buildings, Holborn, London, E.C.1. Made of bakelite, it is available in six colours and incorporates a push-bar coloured red on one side and black on the other. The top unscrews to expose the terminals for wiring, and a shade carrier is fitted to the base.

Another development is a neat thermal flasher for batten mounting. It is rated to take 40/100 W on 200/250 V and has a golden brown bakelite body. Specially timed flashers can be supplied, although the usual is 2½ sec. on and ¾ sec. off, the delay in starting from cold being about 10 sec. It is sold by F. W. STURGESS, Park Lane, Ashtead.

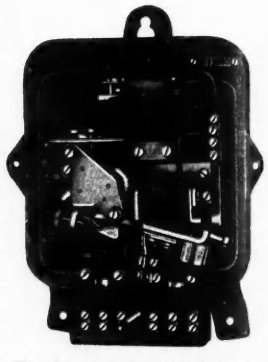


The Andrews push-bar lampholder and the Sturgess batten-type flasher

Delayed-action Switch

A short-period staircase time switch (model "TZF") introduced by LONDEX, LTD., Brettenham House, Lancaster Place, London, W.C.2, is equipped with an adjustable Ferraris movement. The small self-starting motor is, by means of a screw, so adjustable that delay periods ranging between 3 sec. and 45 min. can easily be obtained. The switching capacity is 6 A, 250 V, a.c.

As soon as the push-button is pressed the electro-magnet attracts the armature, closes the 6-A contact, starts the motor and brings the gear in touch with the motor spindle. After a pre-set period the contacts open and the Ferraris movement stops.



The Londex short-period staircase time switch

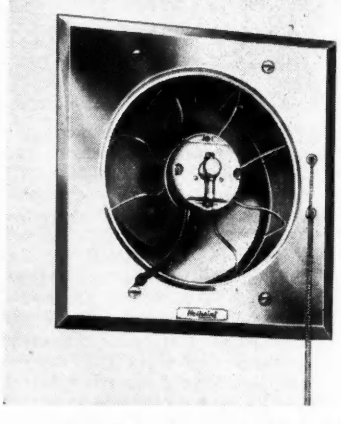
These time switches can be supplied with a special electrically wound master switch for the central automatic lighting of several staircases and floors, with permanent lighting during the evening and push-button controlled lighting during the night. If the master switch is fitted with the Londex solar dial the switching-in occurs automatically.

The simple working principle, without clockwork mechanism, makes it possible for this relay to be applied to motor starters, lifts, medical instruments, television, &c.

A Quiet Ventilating Fan

A feature of the new ventilating fan which has recently been introduced by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street, London, W.1, is its silence, the motor and fan being mounted on a flexible and resilient support which absorbs the normal vibration of the motor and fan blades.

The blades are shaped and pitched to provide a silent high-velocity air delivery sufficient to renew the air in an average-sized kitchen in from three to five minutes, the fan delivering at normal running speed about 500 cu. ft. per minute free air.



The "Hotpoint" ventilating fan

The housing is a welded-steel wall box 12 in. square and finished in green enamel. The outside shutters, which are of weatherproof stainless steel, close automatically when the fan is turned off. The single-speed switch is operated by means of a pendant chain.

British Overseas Electrical Trade

Exports advancing faster than imports

AN important fact which emerges from an examination of the electrical overseas trade figures for August, given in the Board of Trade returns for the month, is that the rate of increase of exports, according to value, is now definitely ahead of imports. At the end of the first quarter of this year exports and imports had expanded by 12 and 19 per cent. respectively; at the half-year the position had improved to 20 and 21; and at the end of last month the figures were 22 and 20 per cent. In eight months exports have risen in value by £2,061,453 to £11,650,192, as compared with an increase of £1,310,172 in the whole of last year. Imports have expanded by £532,233 to £3,235,852, the increase for the whole of 1936 being £685,570.

As usual, exports during August were on a smaller scale than the average for the year. At £1,400,638 they were, however, £298,375 (27 per cent.) in excess of shipments during August, 1936. Imports, at £432,535, were up by £71,253 (20 per cent.). Both months contained 25 working days (*i.e.*, excluding Sundays and Bank Holiday).

Although exports as a whole were of a lower value than for most other months this year, there were several exceptions among individual classes of equipment. The most notable was switchgear, shipments of which, following a decline earlier in the year, have risen continuously during the past four months, as follows: May, £94,340; June, £111,018; July, £122,178; and August, £154,924.

Telegraph and telephone equipment, other than radio, is another instance. It is noteworthy that so far this year shipments of this kind to Australia have amounted to £355,192, against £179,624 in the corresponding period of last year. The chief destinations of such exports during August, with figures for August, 1936, in parentheses, were as follows: Australia, £40,250 (£18,288); South Africa, £17,377 (£13,818); Argentina, £15,818 (£20,686); other British countries, £62,244 (£28,959); and other foreign countries, £41,546 (£34,631).

There continues to be a wide market for British-made wires and cables. Both Empire and foreign countries have contributed to the increase in such exports of nearly £1,000,000 so far this year. In August, the chief destinations of exports of wires and cables other than telegraphic and telephonic, with comparative values for August, 1936, in parentheses, were as follows:—

Rubber insulated wires and cables.—Australia, £36,781 (£24,002); South Africa, £20,930 (£19,257); British India, £14,446 (£12,118); New Zealand, £7,623 (£8,649); other British countries, £18,610 (£11,298); and foreign countries, £16,084 (£11,399).

Electric wires and cables, insulation other than rubber.—South Africa, £54,396 (£20,394); Australia, £34,077 (£17,493); British India, £31,656 (£10,293); other British countries, £28,490 (£19,944); and foreign countries, £20,845 (£12,699).

Analysis of goods and apparatus exports according to countries reveals a further improvement in certain foreign markets, as the following figures for the past three months demonstrate: Rumania, £3,302, £15,787 and £28,126; Belgium, £9,882, £12,340 and £15,919; Sweden, £9,846, £10,663 and £11,021. Denmark and China show substantial advances over August, 1936. In the case of Brazil there was a further recession from the high figures of last year, when apparatus was being shipped in connection with a large railway electrification scheme.

Generating plant exports were only moderate, although shipments to foreign countries were of a much greater value. In the case of motors there was a fairly general improvement, but the greatest advance in the machinery section was in exports of switchgear, transformers, etc., which attained the value of £257,140, an amount exceeded in only one month this year.

EXPORTS AND IMPORTS DURING AUGUST

	Exports. Aug., 1937.	Exports. Inc. or dec. compared with Aug., 1936.	Imports. Aug., 1937.	Imports. Inc. or dec. compared with Aug., 1936.
Submarine telegraph and telephone cables	£15,730	– £596	*	—
Telegraph and telephone wires and cables (not submarine)	40,294	– 5,228	*	—
Other insulated wires and cables	283,938	+ 116,392	£53,622	+ £12,092
Radio receivers, not radiograms (excluding valves)	20,181	– 305	10,478	– 3,813
Radio transmitters (excluding valves)	9,687	– 25,761	*	—
Radio valves	30,173	– 4,316	28,915	+ 16,518
Other radio parts and accessories	40,813	+ 13,363	96,770	+ 8,203
Telegraph and telephone apparatus (other than radio)	177,235	+ 60,858	*	—
Electric carbons	*	—	19,889	+ 7,156
Incandescent lamps	45,283	+ 5,504	15,122	+ 712
Other lighting apparatus	48,448	+ 13,072	49,693	+ 9,493
Primary batteries	16,881	+ 222	*	—
Accumulators	49,310	+ 4,555	*	—
Electric cooking and heating apparatus	26,064	+ 9,771	*	—
House service meters	18,831	+ 1,362	*	—
Other electrical instruments	21,857	+ 9,218	21,614	+ 3,406
Unenumerated electrical goods and apparatus	114,163	+ 7,694	69,781	+ 1,682
Electric generators up to 200 kW	33,724	+ 10,624	*	—
Electric generators over 200 kW	25,906	– 12,496	*	—
Electric motors	105,380	+ 14,014	31,640†	+ 6,270
Convertors and transformers	63,296	+ 11,523	*	—
Starting and controlling gear for motors	24,633	– 9,217	*	—
Switchgear	154,924	+ 68,773	*	—
Other electrical machinery	14,287	+ 5,698	22,859	+ 5,491
Electric vacuum cleaners	19,600	+ 3,651	12,152	+ 4,043
Total	£1,400,638	+ £298,375	£432,535	+ £71,253

* Not classified separately. † Not railway and tramway motors.

The quantity of machinery shipped overseas in August, namely, 2,537 tons, compares with 2,067 tons in the corresponding period of last year. Figures are available only in respect of a few items in the goods and apparatus section. These are (in numbers): Radio receivers, 3,355 (4,541); valves, 138,145 (102,121); electric lamps, 1,425,376 (1,139,037); house service meters, 15,311 (14,644).

Imports were of a greater value in each class except radio receivers, the chief increases being in cables and radio valves.

The number of valves imported was 206,517, against 128,530 in August, 1936. Electric lamp imports were up by only £712 in value to a total of £15,122, but the number rose from 5,425,151 to 7,018,818, the types not being stated.

The chief sources from which electrical goods and apparatus were obtained, with comparative values, were as follows:—

Germany, £90,060 (£66,822); Netherlands, £79,485 (£56,517); United States, £79,146 (£81,593); Belgium, £31,668 (£25,280); Switzerland, £16,866 (£16,328); France, £7,359 (£9,901); Austria, £7,261 (£5,208); other countries, £54,039 (£48,786).

BRITISH ELECTRICAL EXPORTS DURING AUGUST

Destination.	Goods and apparatus, Aug., 1937.	Inc. or dec. compared with Aug., 1936.	Electric generators, Aug., 1937.	Inc. or dec. compared with Aug., 1936.	Electric motors, Aug., 1937.	Inc. or dec. compared with Aug., 1936.	Other electrical machinery, Aug., 1937.	Inc. or dec. compared with Aug., 1936.
Irish Free State	£29,003	– £6,552	*	—	*	—	*	—
Channel Islands	10,668	– 567	*	—	*	—	*	—
Union of South Africa	152,060	+ 45,520	£5,531	+ £3,988	£21,435	– £3,758	£69,055	– £8,37[illegible]
British India	106,743	+ 34,330	2,530	– 2,146	13,556	+ 6,669	36,143	+ 11,042
British Malaya	25,681	+ 4,739	*	—	*	—	6,621	+ 3,577
Ceylon	6,885	– 4,064	*	—	*	—	*	—
Hong Kong	6,547	– 7,802	*	—	*	—	*	—
Australia	158,933	+ 70,594	5,869	+ 645	18,871	+ 2,299	42,009	+ 27,112
New Zealand	87,444	+ 28,409	*	—	4,626	+ 330	15,774	+ 1,307
Canada	12,135	+ 2,047	6,636	– 11,767	11,073	+ 5,119	* 7,344	+ 6,571
Other British Countries	72,539	+ 30,730	16,242	– 9,216	11,218	+ 1,994	31,988	+ 17,323
Sweden	11,021	– 2,219	*	—	*	—	*	—
Denmark	20,367	+ 12,057	*	—	*	—	*	—
Netherlands	9,252	– 4,033	*	—	*	—	3,266	+ 2,611
Belgium	15,919	+ 7,319	*	—	*	—	*	—
France	9,885	– 34	*	—	*	—	2,575	– 207
Portugal	13,475	+ 4,519	*	—	*	—	*	—
Spain	2,996	+ 1,980	*	—	*	—	*	—
Italy	4,391	– 8,040	*	—	*	—	*	—
Greece	3,162	+ 674	*	—	*	—	*	—
Rumania	28,126	+ 8,731	*	—	*	—	*	—
Egypt	5,984	– 106	*	—	*	—	1,495	+ 1,222
China	33,627	+ 13,112	*	—	*	—	1,560	– 1,486
Brazil	5,713	– 34,991	*	—	*	—	*	—
Argentina	32,194	– 3,052	*	—	*	—	5,231	+ 3,431
Other Foreign Countries	94,138	+ 12,504	22,822	+ 16,624	24,601	+ 1,361	34,079	+ 12,644
Total	£958,888	+ £205,805	£59,630	– £1,872	£105,380	+ £14,014	£257,140	+ £76,777

* Not classified separately.

A Census of Electrical Production

IN the five years ended 1935 the manufacture of electrical and allied goods in the United Kingdom has increased nearly fifty per cent. in annual value, the gross output actually rising from about £71,827,000 to £103,287,000. This fact is apparent from statistics relating to the Census of Production (1935) published in a recent issue of the *Board of Trade Journal*.

The larger table analyses the production, exports and retained exports in 1935, together with the corresponding data for the preceding year; reclassification makes a detailed comparison with the 1930 figures of doubtful value, so these have been omitted. The figures do not take into account firms employing ten or fewer persons on an annual average.

When comparing the 1935 figures with those for 1930 a striking feature is the advance in radio apparatus production from £6,324,000 to £15,217,000, the output of radio valves likewise rising from £1,102,000 to £2,211,000. Electric lamp bulbs were valued at £3,347,000 in 1935 as against £2,642,000 in 1930. The manufacture of primary batteries increased from £2,589,000 to £3,480,000 in value, but accumulators declined from £3,160,000 to £2,708,000. Electric motors, other than tramway and railway motors, were much in demand and were produced to the value of £5,420,000 as against £3,779,000. Though not always strictly comparable, the following figures for 1930 are also of interest: Convertors and transformers, £2,785,000; control and switchgear, £5,913,000; carbons, £533,000; electric wires and cables, £19,112; and conduits and fittings, £881,000.

Compared with the preceding year the output for 1935 shows an increase of £11,874,000. Work in progress at the end of the year amounted to £10,542,000, and that in progress at the beginning of the year to £8,316,000. Electrical contract and other work valued at £3,331,000, while £404,000 more than in 1934, shows a decline of almost a half as compared with the figure given for 1930, namely, £1,108,000, but a reason can no doubt be found in the assignment of more of this work to the building and contracting trades section of the census.

Generally speaking, the output of electrical engineering does not lend itself to satisfactory quantitative comparison, but taking into account the difference in price levels it appears that, while there has been a slight falling off in the production of heavier goods during the five years since the previous census, this has been more than balanced by the larger output of smaller appliances, particularly in the domestic field. A revival in the heavy engineering market, too, is apparent from a glance at the 1934 figures.

When making the returns manufacturers were instructed that the values of output to be shown were the net selling values of all deliveries of goods (as packed for sale) within the year of return, plus the book value of stocks at the beginning of the year. In determining the net selling values firms were asked to deduct from the amounts charged to customers such items as discounts, payments to transport firms, railway companies, &c., for carriage outwards, and allowances for returnable cases, etc. Where separate returns were made for different departments of the same company, and goods produced in one department were used in another department in the production of more finished goods, such goods were required to be included in the output of the first (producing) department and in the materials of the second (using) department at the value at which they were transferred in the firm's books.

In arriving at the figures given for net output of the industry there are deducted from the value of the gross output the aggregate and the cost of materials used, and the amount paid for "work given out," together with the amount of any excise duty included in the value of the products and not in that of the materials used. These figures represent the value added to the materials by the industrial processes and, after allowing for sums sufficient to cover the depreciation of plant and machinery, constitutes the fund from which wages, salaries, rents, royalties, rates and taxes, advertisement and selling expenses, and all other similar charges, have been provided, as well as profits.

The cost of materials used increased from £40,306,900 in 1930 to £42,279,000 in 1934 and £47,476,000 in 1935, and the amount paid for work given out to other firms from £218,000 to £265,000 and £277,000 respectively. The net output was £55,534,000 in 1935 as against £48,869,000 in 1934 and £39,447,000 in 1930, while the net output per person employed rose from £218 in 1930 to £225 in 1934 and £231 in 1935. At 239,977 the average number of persons employed in 1935 was 23,132 more than a year before and 59,157 more than five years before. Of these, 53,383 were on the administrative, technical and clerical staffs, the remainder being operatives. About one-sixth were under eighteen and about one-third females. A detailed analysis of the average number of persons employed is given in our smaller table, and it is interesting to compare these figures with those for the mechanical engineering industry in which the average number employed was 420,110 in 1935, 455,588 in 1930, and 438,529 in 1924.

	Production.		Exports.		Retained Imports.	
	1934.	1935.	1934.	1935.	1934.	1935.
	Thous. £.	Thous. £.	Thous. £.	Thous. £.	Thous. £.	Thous. £.
Generators...	1,367	1,699	650	787	22	18
Railway and tramway motors	435	589	40	42	—	—
Other motors	4,592	5,420	948	980	175	231
Convertors and transformers	2,753*	2,724	425	589	15	25
Starting, control and switchgear	6,724‡	7,997‡	1,102	1,531	53	23
Vacuum cleaners	2,540	3,260	98	158	143	241
Ignition magnetos	256	324	18	26	15	36
Other electrical machinery	397	312	113	144	52	31
Electric carbons, including electrodes	1,328	1,567	58	48	161	115
Lighting appliances, accessories and fittings, excluding bulbs	3,102	3,270	403	466	330	379
Electric lamp bulbs	3,009	3,347	Figures not available		Figures not available	
Bell apparatus, not telegraphic or telephonic	75	78	7	9	24	28
Telegraph apparatus (other than wireless)	184	182	1,107	1,722	52	60
Telephone apparatus (other than wireless)	3,744	5,503				
Wireless apparatus, including electrical reproducers but excluding valves	15,339	15,217	1,198	1,113	979	1,048
Wireless valves	2,204	2,211	Figures not available		Figures not available	
Insulated wires and cables	14,681	17,033	2,158	2,684	231	239
Insulated copper wire	1,372	1,575	Figures not available		Figures not available	
Conduits and fittings	658	320	Do.		Do.	
Cable jointing, boxes, etc., and overhead line fittings	1,012†	1,076	Do.		Do.	
Electric signalling apparatus (including traffic signals)	393	431	Do.		Do.	
Primary batteries	3,661	3,480	230	231	17	25
Accumulators and parts	2,787	2,708	525	503	7	15
Electric condensers	739	851	Figures not available		Figures not available	
House service meters	2,410	2,204	Do.		Do.	
Other electricity meters	120	141	Do.		Do.	
Commercial measuring instruments and parts	751	815	108	138	44	49
Scientific electrical instruments	537	539	54	65	82	89
Electro-medical apparatus, including X-ray apparatus and vacuum tubes	242	247	51	46	99	128
Domestic heating apparatus	1,418	1,346	186	222	77	140
Commercial and industrial heating apparatus	289	184				
Electric cooking apparatus	1,228	1,566				
Electric signs	439	477				
Electric totalisator apparatus	29	267				
Electric fans	160†	262				
Portable electric tools	123	195				
Sound recording equipment other than electrical reproducers†	61	64				
Electric irons†	18	50				
Permanent hair-waving apparatus	247	255	Figures not available			
Electric hair dryers	54	66				
Insulating materials	974	1,127				
Refrigeration machinery	609	728				
Electric lifts, cranes, hoists, etc.	80	90				
Electric welding machinery not recorded separately	—	115				
Other electrical apparatus	828	1,649				
Other allied manufactures	2,983	3,933				

* Including rectifiers.
† So far as recorded separately.
‡ Including switchboards.

Persons employed	Males		Females		Total	
	Under 18	All ages	Under 18	All ages	Under 18	All ages
Operatives (average for the year):—						
1935	20,732	119,407	16,570	67,187	37,302	186,594
1934	17,407	105,340	15,477	63,583	32,884	168,923
Administrative, technical and clerical staff*:						
1935	2,392	37,320	3,212	16,063	5,604	53,383
1934	1,895	33,259	2,408	14,663	4,303	47,922
Total 1935	23,124	156,727	19,782	83,250	42,906	239,977
Total 1934	19,302	138,599	17,885	78,246	37,187	216,845

* As at October 12th, 1935 and October 13th, 1934.

The growing appreciation of the advantages of the individual electric-drive is apparent from the increasing number of small electric motors employed in the various factories concerned. In 1934 the number of fractional-h.p. motors installed was given as 266,340: by the next year no fewer than 348,622 were in use. Factory electrification is indeed going ahead in all departments, large advances in all types of electrical equipment—generators, motors, convertors, transformers and the lighter apparatus being recorded. Altogether a total of 407,928,000 kWh of electricity was consumed in electrical manufacturing works in 1935 and of this 357,618,000 kWh was purchased. In 1930 only 204,200,000 kWh was used.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Manchester Apprentices' Strike

At the beginning of last week apprentices to engineering concerns in the Manchester and Salford district ceased work to enforce a demand for an increase of 3s. a week in their wages and the right of the Amalgamated Engineering Union to negotiate agreements for them. This week it was reported that the strikers numbered 10,000 and that the A.E.U. Manchester District Committee was giving favourable consideration to the payment of strike benefits to such of them as are members—about 2,000. This lead was later followed by the E.T.U. and other unions. According to the *Manchester Guardian*, forty-two concerns are affected, including the following: Mather & Platt, Ltd., Crossley Bros., Ltd., Ferranti, Ltd., the Metropolitan-Vickers Elecl. Co., Ltd., Lancashire Dynamo & Crypto, Ltd., Ferguson, Pailin, Ltd., Erskine Heap & Co., Ltd., and Salford Electrical Instruments Ltd. The matter in dispute is under consideration by the Manchester District Engineering Employers' Association. Mr. G. E. Bailey, director of works, Metropolitan-Vickers Co., addressed a gathering of apprentices and their parents and friends at the annual "speech day" last Saturday. He said that in ceasing work the apprentices had broken their agreements and the company could not negotiate with them until they returned. If they did this the employers would endeavour to obtain an early decision regarding the application for increased wages. The employers had always maintained that until apprentices reached the age of twenty-one their conditions were solely the concern of themselves, their parents and their employers. Now, however, trade union leaders were negotiating with the Engineering Employers' Federation for the right to negotiate for apprentices.

After a meeting on Monday last the Lancashire and Cheshire Committee of the Engineering Employers' Federation stated that no consideration of the claim could be made while the apprentices remained on strike. When they resumed work the claim would be considered. Some apprentices returned early this week, including lads in the works of the Metropolitan Vickers Co., the Lancashire Dynamo Co., and Erskine, Heap & Co., but the latest reports indicate that the strike is spreading.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry announces that the September 1st cost-of-living figure (55 per cent. above the 1914 level) will not involve any alteration in the wages of workers in the industry on the third pay day in October.

Displaying Christmas Tree Lamp Sets

Crompton Parkinson, Ltd., have produced an attractive display piece as the packing for their Christmas Tree lamp sets. A cut-out Christmas tree, 20½ in. high, 12 in. wide, in three colours with sockets for the lamps which light in position on the tree, and a stand-up base should persuade the dealer to use this as a part of his Christmas window display. The whole is packed in an outer box and the lamps are sold complete with display set and carton.

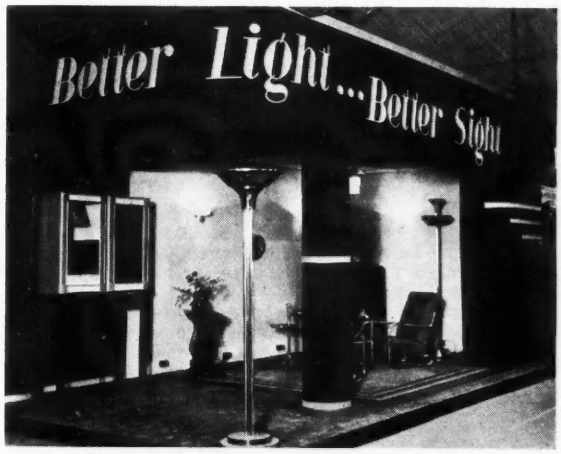
A window display of "Baby Belling" cookers at the showrooms of the Ealing Electricity Department

Manchester Radio Exhibition

Manchester's Radio Exhibition was opened at the City Hall on September 14th by Lord Colwyn, his speech being broadcast from the inaugural luncheon at the Midland Hotel to the stands at the City Hall. He spoke of the great strides which had been made in the industry since the first Manchester Radio Exhibition in 1924. Apart from the headway made in the design and reception of modern receivers, which was clearly demonstrated at the exhibition, the great value of radio for other purposes than mere enjoyment was shown by exhibits staged by the Army, the R.A.F. and the Post Office. On the R.A.F. stand a complete aero bomber was displayed, and the receiving and transmitting sets on this were explained by trained men. Radio was also a very important component of the Post Office organisation.

A Lighting Campaign in the F.M.S.

The accompanying illustration shows a display by the Electrical Department, Malay States, at a recent exhibition in Kuala Lumpur, F.M.S. The opportunity was taken to illustrate the advantages of a modern and correctly designed system of illumination for the home, the correct methods being compared with ordinary pendant lighting by means of an automatic switching arrangement. The acting senior electrical engineer, Selangor, in sending us the picture, states that the interest evinced by both European and Asiatic sections of the community gave encouragement for further efforts in the development of better lighting.



A "Better Light—Better Sight" display in the Federated Malay States

A Cooker Display at Ealing

The accompanying illustration shows a window display in the showrooms of the Ealing Corporation Electricity Department arranged in co-operation with Belling & Co., Ltd. As will be seen, a special feature is made of the "Baby Belling" cooker, and during the past fortnight cooking demonstrations have been given in the window itself by one of the company's demonstrators.

Conditions in Chile

In his report to the Department of Overseas Trade on economic and commercial conditions in Chile (Stationery Office, 1s.), Mr. J. Mitcheson, Commercial Secretary, Santiago, states that 1936 was a year of steady consolidation in nearly all lines of business. The upward trend was moderate until the end of the year when exports, particularly copper, increased sharply both in volume and value as a result of European rearmament. From January, 1937, onwards exports rose rapidly, while imports remained low. This exceptional improvement, however, may prove to be transitory. The demand for copper was due to political rather than economic considerations, and the main profits from Chile's copper industry were taken by New York holding companies. The drop in United Kingdom exports to Chile was partly explained by German price competition which was aided by a 30 per cent. depreciation of the mark and by export subsidies, and partly to the action of the Chilean exchange control in placing restrictions and surcharges on certain types of imports. The average monthly production of copper bars rose from 13,064 metric tons in 1933 to 21,661 in 1935, and while it declined in 1936 to 20,440 metric tons, owing to the international restriction agreement in force during part of the year, it increased at the end of 1936 to 27,000 tons and was in January, 1937, running at 34,300 tons, with plants working

full time. Chilean copper production in 1936 was about 18 per cent. of world production, and for the current year the proportion may exceed 20 per cent. Annual production figures of copper bars for the last three years in metric tons were 247,721 in 1934, 259,930 in 1935 and 245,281 in 1936, while the leading importers of Chilean copper during 1936 were, United Kingdom (75,350 metric tons), United States (60,540), France (30,000), Italy (26,000), Sweden (12,300) and Germany (5,800). Copper exports for 1937 are estimated at 350,000 metric tons, as compared with 240,125 metric tons in 1936. With regard to the State undertakings and public utilities, Mr. Mitcheson states that no important developments occurred during 1936, except that the Government acquired partial control of, and a financial interest in, the principal electric light and power concern, the Cia. Chilena de Electricidad, a subsidiary of the American and Foreign Power Corporation, New York, and the largest public utility company in Chile, apart from the Chilean State Railways. The Chile Telephone Co. has retained its independence and continues to improve its services. It is now possible to telephone to all parts of the country except Arica in the North and Aysen and Magallanes in the South. Plans are, however, fairly advanced for linking up these outlying localities by radio telephony. In an appendix particulars are given of the values of the principal Chilean imports in 1936 from which we have extracted the following electrical items. The values are shown in thousands of gold pesos of 6d., and the figures for 1935 are given in parentheses: Electric motors 1,167.6 (870.5), insulated wire 2,859.8 (1,963.5), electric lamps 1,308.5 (1,261.2), and telegraph and telephone apparatus 1,359.6 (864.4).

A display of Crompton "Neophan" glassware at Manchester

B.I.F. By Camera

An illustrated brochure, showing at a glance the variety and range of products assembled in London and Birmingham for the British Industries Fair, will shortly be distributed to 100,000 importers in more than 100 Empire and foreign markets. This guide, in which the cameraman has selected a diversity of goods, is printed in nine languages and gives all the salient facts relating to the 1938 Fair.

Steels in the Electrical Industry

An information bureau on special steels has been founded by the Brymbo Steel Co. The bureau, which is a feature of the recent reorganisation of the Brymbo works, will be in charge of Mr. T. Roberts, the company's chief metallurgist, and will be available for the supply of information on the application of specialised steels of every kind used in the electrical industry.

Berry's Works Extensions

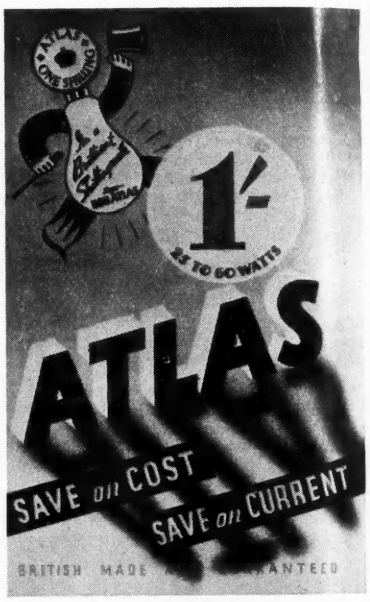
The extensions to the Birmingham works of Berry's Electric, Ltd., which will provide additional floor space of about 20,000 sq. ft., have just been completed. Music is broadcast throughout the works at certain times of the day, by which means it is hoped to increase the rate of production. The accompanying illustration shows the front elevation of the offices and showrooms.

Exhibitions of Crompton Products

The recent exhibition of Crompton products to the trade at the Midland Hotel, Manchester, proved very successful, and additional exhibitions have been held at the Metropole Hotel, Leeds (September 14th, 15th and 16th) and the Grand Hotel, Birmingham (September 21st, 22nd and 23rd), while a further display will be held at Connaught Rooms, London, on September 28th, 29th and 30th. Apart from exhibiting lamps, fans, small motors, &c., the company is demonstrating two new lines, namely, "Neophan" glassware and the Crompton discharge lamp. By the introduction of neodym-oxide into the glass of "Neophan" fittings during manufacture the predominance of yellow rays peculiar to the spectrum of tungsten filament lamps is reduced. In this way the glassware not only gives a warm, natural tone to colours, but also provides adequate diffusion and permits high light intensities. These fittings are particularly suitable for use in public places such as restaurants, hotels and shops. The recent display at Manchester is shown in the accompanying illustrations.

Lamp Publicity

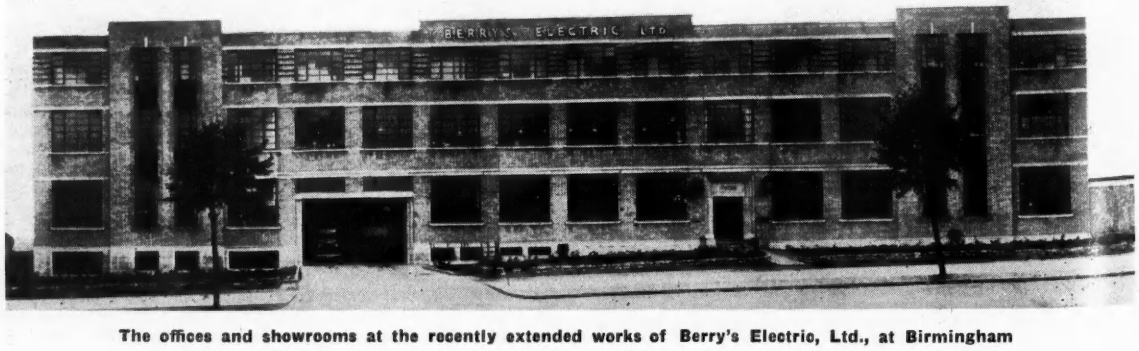
A handy booklet with a multi-coloured cover gives brief information of the Atlas range of general purpose and special lamps. "Bob Atlas" is again to the fore with his slogan "I'm a brilliant Shillingsworth." He conveys the same message on the back page. Inside are descriptions of various types of Atlas lamps for household and general use. Thorn Electrical Industries, Ltd., is also issuing a window bill drawing attention to its "Atlas" lamps.



An Atlas lamp sales reminder

The Grocers' Exhibition

Weighing and packing provide the principal source of electrical interest at this year's Grocers' Exhibition now being held at the Agricultural Hall, Islington. Extreme accuracy is a strong feature of the latest weighers, a small electrically operated machine made by the Automatic Weighing & Packing Machine Co. for filling envelopes with ¼-1 oz. of tea for café or restaurant use being capable of giving thirty-two accurate weighings per minute to within one grain. For the sake of portability and easy fixing this machine is provided with a plug fitting and like all this company's equipment has a new



The offices and showrooms at the recently extended works of Berry's Electric, Ltd., at Birmingham

patented clutch with simple control. Demonstrations of a number of Hoeller automatic filling and packing machines, newcomers to the show, are given by the Benhil Machine Co., Ltd., while among a quantity of new weighing equipment on the stands of Southall & Smith, Ltd., is to be seen an automatic density filling machine which fills containers of all sizes with powders. "Rapid" mixers, sifters and grinders of various types are Wm. Gardner & Sons' contribution to the display, and a stopper and lid pressing machine complete with conveyor is shown working by Albro Fillers & Engineering Co. The Purdy Patent Machinery Co.'s "New Way" labeller can label 200 bottles, &c., per minute and can be reset from one size to another in two minutes. In addition to its better known coffee roasting and grinding machines for hotels and restaurants, the Uno Co., Ltd., is making a special feature of its larger apparatus, in particular the 28-lb. capacity warehouse roaster and cooler. Electrically operated slicing and other food preparation machinery is a speciality of Berkel & Parnall's Slicing Machine Mfg. Co., Ltd., and Parnall & Sons, Ltd. Visitors can see demonstrations of egg grading on the stand of J. J. Moore. The exhibition closes to-day (Friday).

An Electric Vehicle Exhibition

An electric vehicle exhibition will be held on September 28th at the electricity sub-station, Seaview Road, Wallasey, under the auspices of the Electric Vehicle Committee of Great Britain, Ltd. The exhibits will include electric vehicles suitable for delivery of milk, bread, mineral waters, and groceries, electric batteries which provide the motive power, and battery charging equipment. A short address will be given by Mr. R. C. Hawkins, secretary, North West Area, Electric Vehicle Committee. Mr. B. T. Hawkins, borough electrical engineer and manager, Wallasey, is to preside. Vehicles will be available for trial runs.

A New Publication

"Complete Electrical Engineering" is the title of a new work which is to be issued in forty weekly shilling parts by Messrs. George Newnes, Ltd.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price. September 22nd	Fortnight's Inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal)... „	£18 10s.	—
a Borax ... ... „	£17	—
a Copper, Sulphate ... ... „	£22 10s.	—
a Potash, Chlorate ... ... per lb.	3½d. to 4½d.	—
a „ Perchlorate ... ... „	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a „ Roll ... ... „	£11	—
a Soda, Chlorate ... ... per lb.	3¾d. to 3¾d.	—
a „ Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b „ Wire ... ... per lb.	1/1 to 1/9	—
b „ Sheet and Foil ... ... „	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£242	£7 dec.
Grade II ... ... „	£168	£4 dec.
Grade III ... ... „	£89	£2 dec.
c Brass (rolled metal 2" to 12" basis)... per lb.	9½	⅝d. dec.
c „ Tubes (solid drawn) ... ... „	1/0½ to 1/0½	½d. dec.
c „ Wire, basis ... ... „	9½	⅝d. dec.
c Copper Tubes (solid drawn) ... „	1/1½	½d. dec.
g „ Bars (best selected) ... per ton	£89	£2 dec.
g „ Sheet... ... ... „		
g „ Rod ... ... „		
d „ (Electrolytic) Bars ... ... „	£58 10s.	£9 dec.
d „ „ Wire Rods ... „	£63	£9 10s. dec.
d „ „ H.C. Wire ... per lb.	9½d.	½d. dec.
f Ebonite Rod ½" dia. & up ... ... „	1/10 to 2/9	—
f „ Sheet ⅛" thick & up ... ... „	1/7 to 1/10	—
n German Silver Wire, Nos. 1 to 12... „	2/5	—
h Gutta-percha, fine ... ... „	nom.	—
h India-rubber, Para-fine ... ... „	9½d.	—
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s.	—
i „ Wire galv. No. 1, P.O. Qual.... „	£23	—
g Lead, English Pig ... ... „	£22 5s.	£1 10s. dec.
g Mercury ... ... per bot.	£13 12s.	—
e Mica (in original cases) small ... per lb.	10d. to 2/–	—
e „ „ „ medium ... „	6/– to 12/6	—
e „ „ „ large ... „	13/– to 17/6 up	—
p Phosphor Bronze, plain castings ... „	1/3½	—
p „ „ drawn bars & rods „	1/3	1d. dec.
p „ „ rolled strip & sheet „	1/1	1d. dec.
p „ „ wire ... ... „	1/2½	½d. dec.
o Platinum ... ... per oz.	£10 5s.	—
d Silicium Bronze Wire ... ... per lb.	10½d.	1d. dec.
g Spelter ... ... per ton	£20 5s.	£2 13s.9d.dec.
r Steel, Magnet, in bars ... ... per lb.	7½d.	—
g Tin, Block (English) ... ... per ton	£260 5s.	10s dec.
n „ Wire, Nos. 1 to 16 ... ... per lb.	4/3	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

A Domestic Appliance Sales Conference

Further assistance for dealers in selling domestic vacuum cleaners, refrigerators, and laundry equipment will be forthcoming as a result of modincations of the sales policy of Vactric, Ltd., and its newly formed associate, Apex-Vactric, Ltd. Outlining the proposals at a sales conference presided over by the chairman of both companies, Mr. S. Kingsley Tubbs, at Grosvenor House, W.1, on Monday, Mr. L. E. Le Vee, joint managing director, said that they proposed to continue their policy of dealing only through the trade and would do everything posible from the standpoint of manufacturing, price, advertising and sales to stimulate the progress of the business. To meet the competition of those companies which were selling direct to the consumer through highly trained sales staff they had found it necessary give dealers the benefit of similar specialised sales assistance. In order to bring the wholesaler into the plan, as from October 1st, district representatives would be able to put orders taken from a dealer through a wholesaler if the the dealer wished. Special discounts would make it possible for the dealer to employ "speciality" salesmen, and, as from the first of the month the company's trained corps of salesmen will be absorbed by the distributors. Advertising had been increased by 33⅓ per cent., and sellers of the company's products had the advantage of handling the largest complete range of domestic electrical appliances in the world. Service, co-operation, personnel and the benefits of the technical developments of the American Apex Co. were behind them. Describing manufacturing extensions, Mr. C. T. Pegley, another director, stated that within two months 16,000 sq. ft. of floor space would be added to the vacuum cleaner factory at Cricklewood, providing additional accommodation required for the planning and production departments. The recent fire, which completely destroyed the armature department, caused little dislocation of work, and they were in full production again in three days. Early next year an 80,000 sq. ft. factory would be completed at Queensbury for use as general offices and for the production of washing machines, ironers, and refrigerators. Mr. A. Caldwell Young presided at lunch, and Mr. E. C. Stacey was M.C. at dinner at the London Casino.

International Exchange of Business Men

A new committee known as "The Committee for the Exchange of Young Business Men" has begun operations with the intention of making a practical contribution toward the betterment of international relations. Employers who wish to exchange a young member of their office or works staff for an employé of a Continental firm for a year's experience, or young Englishmen who desire, with their employers' concurrence, to exchange jobs with young foreigners for a period, are invited to write to the Committee at 14, Queen Anne's Gate, S.W.1.

Trade Announcements

The head office of Electrical Commodities, Ltd., is now at Sparton Works, Beresford Avenue, Wembley, Middlesex. The offices at 415-417, Oxford Street, W.1, will be retained as showrooms.

Brilliant Signs, Ltd., has approved plans for a new factory which will be a three-storey building and will be put in hand as early as possible in the coming year.

Hogan & Wardrop, Ltd., 25, Old Street, London, E.C.1 (telephone: Clerkenwell 9766-8; telegrams: Tribord 'Phone, London) have been appointed agents for London and the South for McClure & Whitfield.

Employment During August

Employment during August in the engineering industry declined slightly in some districts, but was generally good on the whole, remaining very good in electrical engineering. According to the *Ministry of Labour Gazette* the total number out of work in the engineering industry was 61,001, an in rease of 2,368 as compared with the preceding month, but 16 461 fewer than in the corresponding month of 1936, the percentage being 5.7. In the electrical engineering section the number of unemployed was 3,169 (3,018 in July) or 3.1 per cent. (3.7 per cent. in August, 1936). The unemployed in the electrical wiring and contracting industry numbered 4,004, or 10.5 per cent. (11.2 per cent. in July and 11.9 per cent. in August, 1936). In the cables, apparatus, lamps, &c., group the unemployed numbered 6,870, the percentage falling from 4.6 to 4.5 (5.1 per cent. in August, 1936).

New Catalogues and Lists

Simplex Electric Co., Ltd., Oldbury, Birmingham.—A catalogue of the new season's electric fires, illustrated in colour.

Wild-Barfield Electric Furnaces, Ltd., Elecfurn Works, North Road, Holloway, London, N.7.—A pamphlet illustrating various types of electric heat treatment furnaces.

Midland Electric Mfg. Co., Ltd., Tyseley, Birmingham, 11.—An 80-page illustrated catalogue of switch-fuse and motor-control gear, including several pages of hints to users.

Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.—A catalogue of horizontal opposed cylinder type 60 to 1,000 b.h.p. Diesel engines.

Franco-British Electrical Co., Ltd., 25/27, Oxford Street, London, W.1.—A catalogue of fluorescent tubes.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, London, W.C.2.—New catalogues of electric lighting fittings, clocks and lamps.

A. F. Bulgin & Co., Ltd., Abbey Road, Barking.—A copy of "Radio Progress," dealing with ten tested circuits and a 72-page "Radio Service Manual" (1s. 6d.), which includes 250 circuits and diagrams in connection with fault finding.

Londex, Ltd., Brettenham House, Lancaster Place, Strand, London, W.C.2.—A leaflet on electro-magnetic relays.

Power Contracts (Batwin), Ltd., 138, Southwark Street, London, S.E.1.—A 32 page catalogue of electric motors, giving full dimensions.

Holophane, Ltd., Elverton Street, Vincent Square, London, S.W.1.—A souvenir brochure dealing with Holophane lighting for the Coronation ceremony in May last.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—A catalogue of electric-discharge lamps and equipment.

Co-operative Wholesale Society, Ltd., Dudley, Worcs.—Catalogues of domestic electrical appliances and lighting fittings.

British Sangamo Co., Ltd., Cambridge Arterial Road, Enfield.—A leaflet describing a new stop watch.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Leaflets illustrating arc welding equipments.

Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2.—A 150-page catalogue, illustrating and briefly describing almost every kind of domestic electrical appliance (excluding fires and lighting fittings), has again been issued by the "Sunco" in square backed form. The matter in this 25th edition has been rearranged.

Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.4.—Catalogue No. 78, describing fully and illustrating on thick art paper cables, junction boxes and accessories for wiring systems.

Vent-Axia, Ltd., 9, Victoria Street, London, S.W.1.—A leaflet showing the uses of air extractor fans.

Lincalux, Ltd., 119/123, Cloudesley Road, London, N.1.—A catalogue of reflector and sign specialities, striplights and accessories.

Rowlands Electrical Accessories, Ltd., Hockley Hill, Birmingham, 18.—A catalogue of heating appliances.

Bull Motors, Ipswich.—A leaflet dealing with silent motors.

Northern Steel & Hardware Co., Ltd., 7, Gartside Street, Manchester, 3.—A radio catalogue for 1937/38.

Company Liquidations

Peterborough Radio Co., Ltd., Queen Street, Peterborough.—The statutory meeting of creditors was held recently at the Bedford Commercial Hotel, Peterborough, when resolutions were passed confirming the voluntary liquidation of the company with Mr. Stephenson, of Stephenson, Smart & Co., Peterborough, as liquidator. A committee was also elected consisting of the representatives of Churchman's, Ltd., Radio Supplies and Reeds Garage, Ltd. The statement of affairs showed ranking liabilities of £2,242, of which £1,534 was due to unsecured creditors, and there were cash creditors for £887, who held hire-purchase agreements valued at £169. The net assets were £272, leaving a deficiency as regards the creditors of £1,970.

Aerodyne Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. W. H. Cork, 19, Eastcheap, E.C.3.

Bankruptcy Proceedings

E. A. V. Burton, 14, St. Peter's Park Road, Broadstairs, electrical engineer and radio dealer.—Liabilities of £604 and assets of £22, leaving a deficiency of £582, were disclosed at this debtor's public examination held recently at the Guildhall, Canterbury. The failure was attributed to bad debts, heavy overhead expenses in relation to turnover and lack of capital. The case was closed.

L. C. Wright, "Dalton," Beechley Road, Wrexham, Denbighshire, lately carrying on business at Chester Street, Mold, Flintshire, radio dealer.—This debtor appeared for public examination recently at the County Hall, Wrexham, on accounts showing gross liabilities of £442 and estimated assets of £159, of which £45 is due for preferential claims. The examination was adjourned in order that a trading account might be filed.

E. F. Hunt, radio and electrical dealer, "St. Albans," Cherry Chase, Tiptree, Essex.—Receiving order made September 9th on a creditor's petition.

W. Gallagher (Driver Bros.), radio, electrical and cycle dealer, 14, Ivegate, Yeadon.—Receiving order made September 11th on debtor's own petition.

H. T. Cable (Light House), radio and electrical engineer, 171, Fog Lane, Didsbury, Manchester.—Public examination September 24th at the Court House, Quay Street, Manchester.

H. E. Carr, electric lamp distributor, 24, Glenthorn Road, Newcastle-upon-Tyne.—Public examination September 27th at the Court House, Newcastle-upon-Tyne.

L. C. Rowse, radio and electrical engineer, 20, Western Place, Penryn, Cornwall.—Public examination October 25th at the Town Hall, Truro.

C. G. Smith, electrical contractor, 66, Lichfield Street, Wolverhampton.—Application for discharge to be heard on October 8th at the County Court, Wolverhampton.

F. Pyle (F. & E. Pyle), wireless engineer, Station Road, Okehampton.—Trustee, Mr. W. J. Ching, 3, Sussex Terrace, Plymouth, released August 14th.

F. H. Horsley (Electro Engineering Works), engineer, 3, Brookfield Road, Goldington, Bedford.—Trustee, Mr. T. Bengough, 6, The Parade, Northampton, Official Receiver, released September 7th.

G. Ireland, electrical engineer, near The Oak Inn, Fambridge Road, Maldon, Essex.—Trustee, Mr. J. L. Poland, 29, Russell Square, W.C.1, Official Receiver, released September 7th.

F. H. Villiers (Vacuum Cleaner & Electrical Appliance Co.), electrical engineer, 72, Park Hill, Clapham, S.W.4.—Trustee, Mr. C. R. Waterer, 29, Russell Square, W.C.1, Official Receiver, released September 7th.

N. Millard, wireless, cycle and electrical engineer, 1, Mercatoria Street, St. Leonards-on-Sea.—First and final dividend of 3s. 0½d. in the £, payable September 21st at 8, Old Steine, Brighton.

A. E. Baker, electrical engineer, 42, Chapel Road, Bexley Heath.—First and final dividend of 5½d. in the £, payable September 24th at 280a, High Street, Rochester.

Dissolution of Partnership

J. Ball & Co., radio dealers, electricians, ironmongers, &c., 34, Rawmarsh Hill, Parkgate, near Rotherham.—Messrs. J. Eyre, J. A. Ball and R. Henfrey have dissolved partnership so far as concerns Mr. Eyre, who retires from the firm. Messrs. Ball and Henfrey will attend to debts and carry on the business.

Electricity Supply

Lighting, Domestic, Power

Birkenhead.—ELECTRICAL PROGRESS.—Mr. F. E. Spencer, the borough electrical engineer, in his annual report, states that during the past year 93.5 million kWh was sold, compared with 53.8 million kWh in the previous year, an increase of 39.7 million kWh, or 74 per cent. This exceptional increase was mainly due to the bulk supply to Lever Brothers, Ltd., Port Sunlight, which was commenced on August 1st, 1936, and accounted for 32.4 million kWh. The net surplus amounted to £12,135, compared with £5,560 last year. The kWh generated during the year totalled 164,950, as compared with 492,111 in 1935-36. Consumers totalled 47,312, against 44,156. There were, at March 31st, 6,836 consumers on the domestic tariff, an increase of 1,276, or 23 per cent. The number of consumers adopting electric cooking continued to increase satisfactorily. The total number of cookers in service at March 31st was 7,185, a net increase during the year of 1,174, or 20 per cent. Domestic appliances on simple hire, hire purchase, and sold by the Department, now exceed 50,000, which number does not, of course, include many appliances purchased privately by consumers. There was an advance of 18 per cent. in power supplies, chiefly due to increased activity in the shipbuilding yards.

Birmingham.—FLUE GAS CLEANING.—With the object of minimising the atmospheric pollution due to the discharge of grit and dust from the power station chimneys, the Electric Supply Department has put into operation at the Hams Hall and Nechells power stations a new system of flue gas cleaning. At Hams Hall the combustion gases from the boilers amount to 880,000 cu. ft. per min. at a temperature of 300 deg.; under the new cleaning system these are passed through a steel pipe, 19 ft. in diameter, into a chamber in which are mounted two sets of electrodes with a combined potential of 50,000 V. The dust particles in the gas receive an electric charge and are attracted to one set of electrodes; they are then shaken mechanically into a hopper below which empties on to a continuous conveyor. The cleansed gas is discharged into the atmosphere through two new brick chimneys 350 ft. high with an internal diameter of 20 ft. at the top. At the Nechells station a similar plant has been installed, dealing with 396,000 cu. ft. of gas per min. The new system has resulted in as much as 100 tons of dust being removed from the gases in every twenty-four hours. The bulk of the dust particles are about 0.005 mm. in diameter.

Bridgend.—DOMESTIC CHARGE REDUCED.—The running charge under the Electricity Department's domestic tariff is being reduced to ½d. per kWh.

Brierfield.—METERS.—Application is to be made to the Electricity Commissioners for sanction to borrow £2,000 for the purchase of electricity meters.

TWO-PART TARIFFS.—The following two-part tariffs have been decided upon: Lock-up shops and business premises, £1 per annum per 100 W of installed lighting, with a "unit" charge of ½d.; houses and shops, £1 per annum per 100 W of installed lighting used for shop purposes and a fixed charge of £3 per annum for the house portion, with a "unit" charge of ½d.

Brighton.—SCHOOL HEATING.—The Education Committee is to install an electrical heating system at Pelham Street School at a cost of £486.

Bury.—SODIUM LIGHTING.—A sodium street lighting installation has recently been completed at Manchester Road, Bury. It comprises sixty-eight Revo C.9685 silvered mirror reflector fittings, each containing a "Philora" 150-W sodium lamp, centrally suspended on span wires 25 ft. high and at intervals of 114 ft.

Cardiff.—CHANGE-OVER.—The Electricity Committee is to effect a change-over from d.c. to a.c. in Charles Street at an estimated cost of £2,850.

TEST-ROOM EQUIPMENT.—The Electricity Committee is to purchase further test-room equipment at a cost of £200.

Cockermouth (Cumberland).—OVERHEAD LINES IN BORROWDALE.—Approval has been given by the Rural District Council to an application of the Mid-Cumberland Electricity Co. for consent to the erection of overhead lines along Borrowdale Valley to Honister slate quarries.

Derby.—NEW BOILER INSTALLED.—The borough electrical engineer (Mr. F. Nicholls) reported to the Electricity Committee last week that the installation of the new 110,000-lb. boiler and auxiliary plant at the power station had been completed. It was decided to have an official inauguration ceremony.

East Ham.—STREET LIGHTING.—The charge for electricity for street lighting has been reduced to 1d. per kWh.

LOAN.—Sanction has been obtained by the Electricity Committee to borrow £9,095 for sub-stations and mains at Vicarage Lane and Sandford Road sewage works. The Committee is seeking sanction to borrow £50,000 for domestic apparatus.

Exeter.—SUB-STATIONS.—A new sub-station has been erected, equipped and put into service at the Odeon Cinema, Sidwell Street. On account of the growth of load the Exwick Road sub-station has been extended and equipped with 6,600-V switchgear and transformers. A new sub-station has been erected and equipped at the John Stocker School.

Hastings.—LOAN.—The Electricity Committee has obtained sanction to borrow £10,000 for sub-stations and equipment.

PROPOSED SUPPLY.—A revised estimate of £2,480 for the provision of electricity to the Ninfield Brick & Tile Co., Ltd., has been approved by the committee.

CABLE-LAYING.—The Committee is to lay a cable for public lighting at Undercliffe at a cost of £327.

Ipswich.—SUB-STATION.—A site in Turret Lane has been obtained by the Electricity Committee for a sub-station.

CABLES.—The Committee is to extend cables at a cost of £10,755.

Lincolnshire.—CHEAPER ELECTRICITY.—The Mid-Lincolnshire Electric Supply Co., Ltd., has decided to reduce its lighting flat rate to 6d. per kWh, and two-part domestic consumers are offered a supply at a running charge of ¾d. a kWh.

London.—ISLINGTON.—The Electricity Committee is to convert premises in Eden Grove, Cantwell, into a meter-testing department at a cost of £1,735.

ST. PANCRAS.—The chief electrical engineer and manager states that without any reliable data of probable demand and consumption it is not possible confidently to determine the tariff under which it would be most advantageous for the Council to be charged for the supply to the new town hall. In the circumstances, he suggests that for a period of twelve months the supply shall be taken provisionally under the Council's special "all-in" two-part tariff, which is applicable to consumers where a substantial portion of the electrical energy taken is used for industrial purposes, *viz.*, a fixed charge of £5 per annum per kW of maximum demand, covering lighting, heating and power, and ¾d. per kWh for all electricity consumed, the latter rate being qualified by a coal clause. If at the expiration of twelve months it is ascertained that any other tariff would be more advantageous to the Council arrangements will be made for such a tariff to operate immediately, and be made retrospective as from July 1st, 1937.

The "Enchanted Garden," one of a number of elaborate coloured lighting set-pieces at Morecambe

Macclesfield.—LOWER CHARGES.—The Electricity Company of Macclesfield, Ltd., has decided to abolish from October 1st the minimum charge hitherto applied in the case of supplies taken under its flat rate tariffs at continuously occupied residential premises and to reduce the service charge for the connection of all premises to the mains. Premises situated not more than 60 ft. from the nearest point on the company's mains will, in future, be connected free of charge. The company also undertakes not to increase, at any rate until the end of the current year, the charges under the assisted-wiring schemes. A further concession will be the abolition, as from January 1st next, of meter rents in the case of supplies taken under the domestic "all-in" and "all-electric" tariffs.

Margate.—STREET LIGHTING.—The Town Council has accepted the tender of the Isle of Thanet Electric Supply Co., Ltd., for lighting Northdown Avenue from Dane Hill to Dalmeny Avenue. It has also been decided to light Canterbury Road between Orchard Road and All Saints Avenue by electricity.

Morecambe.—SPECTACULAR ILLUMINATIONS.—During the first fortnight of the illuminations 100,000 persons passed through the turnstiles, £2,000 was paid for admission and £2,500 was received by the Corporation Transport Department in additional fares. One of the set-pieces represents a naval review and is staged on the stone jetty which juts out into Morecambe Bay. The display commences with the lighting up of the outlines of five warships. From the bridge of each ship red, white and blue rockets are discharged. The outline lighting having been switched off, a searchlight display begins with the beams focused on a central point in the sky. The searchlights then move until the beams are vertical, and the movement is continued, causing the beams to form first a lattice and then a fantail. The searchlights are switched off and the display recommences with the lighting up of the outlines. The effect, particularly at high tide, when the lights are reflected in the water, is most realistic. Another set-piece that has attracted considerable attention is the "Enchanted Garden." The lighting cycle begins with the appearance of a fairy hovering in the air. At the wave of her wand a thatched cottage entwined with rambler roses appears, with, near at hand, a white-bonneted old cottager drawing water from a well. Successive waves of the wand bring into glowing colour a wealth of flowers, send doves flying round their cotes and produce gaily coloured birds and brilliant butterflies. The last flourish frames in a huge floral heart a young gallant paying court to a crinolined beauty while Cupid showers rose petals on them. The elaborate character of this set-piece may be judged from the fact that two and a half minutes are needed to complete one cycle. These and other ingenious lighting effects were arranged by the borough electrical engineer, Mr. P. Clegg, in collaboration with the illumination engineers of Holophane, Ltd.

Motherwell and Wishaw.—THREE KWH A PENNY.—Consumers benefit substantially by tariff changes announced by the Electricity Department (engineer, Mr. W. D. Brassington). Under a new domestic tariff the running charge is ¼d. per kWh when the account is paid within ten days.

Mytholmroyd.—IMPROVED STREET LIGHTING.—An interesting conversion from gas to sodium electric-discharge lighting has recently been completed at Burnley Road by the Electrical Distribution of Yorkshire, Ltd., for the Hebden Royd Urban District Council. The length of the road dealt with in this section is 2¼ miles and the installation links up with that placed in commission a short time ago at Hebden Bridge, making four miles in all. It is designed to give an illumination equivalent to Class E of the B.S.S. for street lighting. The 100-W "Philora" sodium electric-discharge lamps, in "Liverpool" lanterns, are centrally suspended across the roadway, the units being attached to disused tramway poles. The mounting height is 20 ft. 6 in.; maximum spacing, 41 yd.; and minimum spacing, 25 yd. A supply is given from the company's existing low-voltage distribution mains along the route and is fed from four different points. Synchronous time switches are fitted and relays are installed to ensure simultaneous switching of the lighting along the route. Overhead lines strung between the booms of the tramway poles interconnect the lamps. The old and new lighting is illustrated on page 418.

Newport (Mon).—CONCESSION.—The charge for electricity for advertisements is to be reduced to 2d. per kWh for approved installations (except from 4 p.m. to 6 p.m., October to March). The new tariff becomes operative on October 1st next.

North Wales.—PROPOSED BOARD.—The Committee of the North Wales and South Cheshire Electrical Undertakings Association met at Rhyl last week to consider plans for setting up a Board for the generation, transmission, and distribution of electricity throughout North Wales. Mr. Price-White, of Bangor, the secretary of the Association, states that at the request of the Electricity Commissioners details of the Association's proposals are not being made public at this stage. They are to be submitted to the Commissioners.

Norwich.—EXTENSIVE STREET-LIGHTING SCHEME COMPLETED.—Two years ago the Norwich Corporation decided to improve the street lighting in the city, which at that time was wholly electric, and Mr. V. A. Pask, the city electrical engineer, was asked to prepare a scheme. The original installation consisted of 3,833 lamps, totalling 333 kW, there being just over 120 miles of streets in the city. The standard of illumination was particularly low. Actually, over 95 per cent. of the streets were below Class "H" of the B.S.S. for street lighting. A scheme was approved the approximate cost of which was £25,000, and eighteen months ago the work of remodelling was commenced. The new installation consists of 4,397 lamps, totalling 595 kW. All streets in Classes "B," "C" and "D" are illuminated by electric-discharge lamps, of which there are 395, and the remaining streets by means of ordinary lamps and Holophane refractors. The whole of the conversion scheme was recently completed, and on the evening of September 14th, the last section was switched on by the Lord Mayor of Norwich, who was accompanied by members of the Street Lighting, Electricity, Watch and Executive Committees.

SUB-STATION.—The Electricity Committee is seeking sanction to borrow £20,095 for sub-station works.

Rawtenstall.—LOAN.—Sanction has been obtained to loans of £11,124 for mains and services and £1,326 for mains.

Scotland.—LOCHABER SCHEME PROGRESS.—Progress of the British Aluminium Co.'s project for extending its power plant at Lochaber has reached an important stage with the piercing of a 28-ft. rock barrier high up on the slopes of Ben Nevis, between the end of the 15-mile tunnel from Loch Treig and a

400 ft. long access tunnel connecting the additional 70-in. diameter pipes to the power house in the valley. The extension scheme will more than double the electrical power now available and increase the productive capacity of the aluminium factory by one and a half times. Extra dynamos will be installed when the flood waters of the Spey are brought into Loch Laggan.

South Shields.—CHANGE OF FREQUENCY.—The first part of the Town Council's £200,000 scheme for changing the town's electricity supply to standard frequency has been completed.

ILLUMINATIONS.—The number of people who visited the South Marine Park to witness the illuminations display held by the Town Council during the period September 4th-18th was 87,187, an increase of 27,793. On the other hand receipts were down £212 owing to the Council reducing the admission charges. The total receipts were £2,065. The results are considered favourable when the competition by the Sunderland illuminations and the fact that the weather was not good are taken into consideration.

Stockton-on-Tees. — REDUCED ELECTRICITY CHARGES. — The Council has modified its electricity charges in favour of consumers, the new rates to become operative on the accounts for the December quarter. In the borough the lighting flat rate is being reduced from 3¾d.-3½d. (according to consumption) to 3¼d. per kWh, or 4d. per kWh prepayment. The new power rate is in two steps—up to 10,000 kWh per quarter at 1¼d. per kWh, and above at 1d.—instead of in four steps ranging from 1¾d. to 1d. Under the domestic rate the running charge is to be ½d. instead of 1d. up to 240 kWh per quarter, and thereafter ¼d. Day-time consumption under the two-rate lighting system is to be charged at 1¼d. instead of 1½d. per kWh, and for late shop-window lighting there will be a similar reduction. In the Preston and Egglescliffe areas the lighting flat rate will be 4d. instead of 4½d. per kWh, and power 1¼d. instead of 2d. per kWh. The domestic rate running charge, heating flat rate, two-rate lighting, two-rate power, and late shop-window lighting charges will be the same as in the borough.

Swanscombe.—ELECTRICITY CHARGES REDUCED.—The following reductions have been announced by the Kent Electric Power Co. The running charge under the two-part tariff is to be reduced from 1d. to ¾d. per kWh, and the two-part tariff standing charge for business premises from 7s. 6d. to 6s. 3d. per quarter per 100 W of installed lighting.

Taunton.—LOAN.—The Town Council is to apply for sanction to borrow £10,000 for mains and services.

EQUIPMENT FOR METER TESTING.—Authority has been given for the borough electrical engineer to obtain tenders for further apparatus needed to complete the undertaking's meter testing station as a Class A meter station.

Troon (Ayrshire).—STREET LIGHTING BY ELECTRICITY.—A scheme has been adopted by the Town Council for the lighting of streets by electricity. About 350 gas lamps are to be replaced by 110 electric lamps. The initial cost will amount to approximately £3,200.

Traction

Aberdeen.—OPERATIONS DURING 1936-37.—Mr. A. Smith, general manager of the Transport Department, reports that during the past year the total revenue of the tramways was £152,566 and of the motor buses £157,120, the respective gross profits being £35,434 and £17,552 and the net profits £6,463 and £5,763. Statistics with regard to the tramways were as follows: Car-miles, 2,708,803; passengers carried, 38,505,055; kWh per car-mile, 2.343; average cost per kWh, 0.7d.; average traffic revenue per car-mile, 13.447d.; average speed, 8.4 m.p.h.; and number of cars in stock, 109. Bow trippers, designed and patented by the chief linesman, have been installed at the various tramcar termini and have given excellent results.

Ipswich.—TROLLEY-VEHICLES.—The Transport Committee is to extend the trolley-vehicle system at a cost of £5,050.

London.—"TUBE" VENTILATION.—The London Passenger Transport Board is to spend £10,000 during the next few months on improvements to the ventilating plant at certain "Tube" stations. The greater part of the money will be spent on experiments to determine the best method of lowering temperatures during the summer months and eliminating the draughts in subways and on platforms.

Newcastle-on-Tyne.—TROLLEY-BUSES.—A further step in the City Council's scheme for the introduction of trolley-buses on tram routes when tram track renewals become necessary was taken on September 19th, when the tram service on the Brighton Grove-Walker route was replaced by thirty trolley-buses. It is understood that the Fenham route is the next scheduled for conversion.

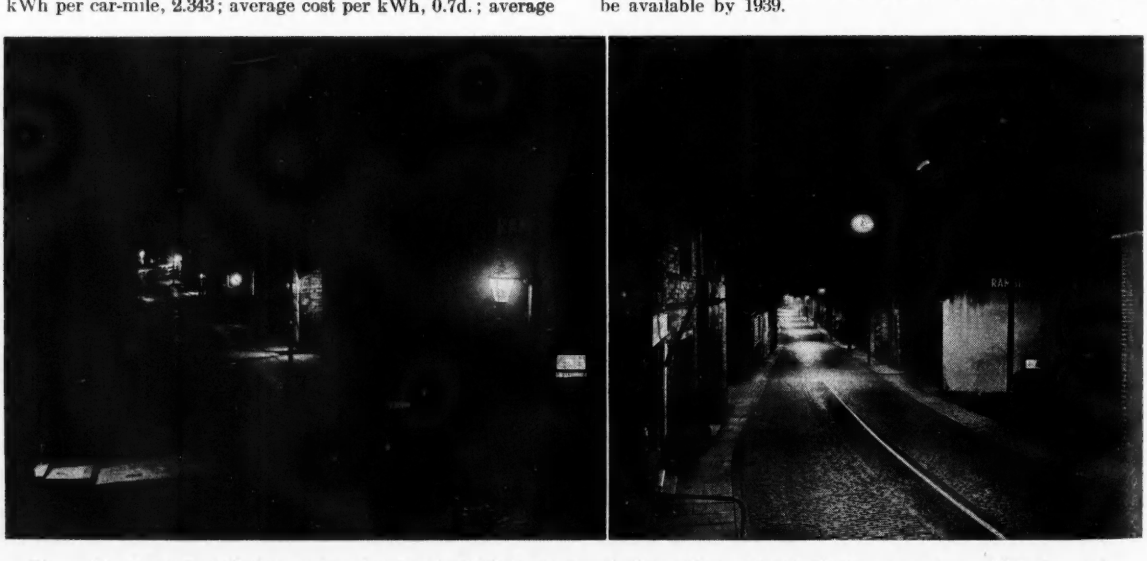
Communications

Canada.—NEW LONG-WAVE STATIONS.—It is reported in *The Times* that the Radio Broadcasting Corporation of Canada anticipates that the two 50 kW long-wave stations, one near Toronto and the other near Montreal, will be ready for operation about October 1st. The construction of similar stations for the Maritime and Prairie Provinces will then be begun, in order to complete, with the addition of the 50 kW station which is already operating in British Columbia, a chain of powerful transmitting stations across the Dominion. Plans are also under consideration for the erection at Ottawa of a powerful short-wave transmitter for the purpose of remedying a deficiency which at present leaves Canada the one important country in the world unequipped to participate in world broadcasting on the short-wave band.

Great Britain.—AUTOMATIC TELEPHONY IN SCOTLAND.—The first stage in the conversion of the telephone system in Glasgow and district to automatic operation was completed on Monday last with the opening of the new "Director" automatic exchange at Halfway, the only one of its kind in Scotland. It is expected that the Glasgow telephone system will be completely automatic by the end of 1940, the scheme embracing thirty-six exchanges. In the immediate future new exchanges at Shettleston, Milngavie and Newton Mearns, within a seven-mile radius of Glasgow, will be opened. The cost of the whole scheme is estimated at over £1,000,000.

Japan.—TELEPHONES AND TELEGRAPHS.—According to *Foreign Communication News*, in connection with the five-year plan for the development of the telephone system in Japan a new company, to be known as the Japanese Telegraph & Telephone Construction Co., has lately been formed in Tokio under the ægis of the Japanese Ministry of Commerce for the manufacture of telegraph and telephone material.

Turkey.—IMPROVING COMMUNICATION WITH IRAN.—Arrangements are being completed between the telegraph authorities of Turkey and Iran (Persia) for the extension of the telegraph facilities between the two countries. The line between Makou (Iran) and Bayazit (Turkey) is to be repaired and doubled, while the transmitting and receiving stations at Tabriz, Bayazit and Erzerum are to be provided with modern equipment. More to the south a telegraph line between Kotour (Iran) and Ban (Turkey) is to be erected. It is also reported that telephone communication between the two countries will be available by 1939.



The original gas installation at Burnley Road, Mytholmroyd, and the sodium electric-discharge system which has taken its place **(see note on page 417)**

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aldershot.—October 5th. Borough Council. Electrical installation at the Isolation Hospital, Cemetery Road. (September 17th.)

Australia.—MELBOURNE.—October 5th. Posts and Telegraphs, P.M.G. Department. Magneto and trembling bells and buzzers. (T. 19182/37.)* Generators and pole-changers. (T. 19183/37.)*
October 12th. Switchboard cable. (T. 19443/37.)*
November 9th. State Electricity Commission of Victoria. Mill-type firing equipment for burning raw brown coal in accordance with Spec. No. 37/92. Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

Bath.—October 7th. City Council. Meter-testing equipment. (See this issue.)

Batley.—September 27th. Electricity Department. A.c. prepayment and ordinary house service type meters. (September 17th.)

Brighton.—September 29th. Borough Council. Duplicate sets of air lift and high lift pumping plant, air compressors and electric motors, each capable of raising 1,500 gal. per hour, with auxiliary plant and other appurtenant works, in connection with the Colony for Mental Defectives, Laughton. Waterworks engineer, 12, Bond Street (deposit £2 2s.).

Bristol.—October 18th. City Council. Wiring for lighting of the administration and ward blocks at Ham Green Hospital. E. S. Hoare & Partners, 39, Broad Street (deposit £2 2s.).

Burnley.—September 29th. Borough Council. Cable. (See this issue.)

Calverley.—October 4th. Joint Hospital Board. Various works, including electrical, at the Woodhall Road Hospital, Thornbury. E. Bray, architect, Stanningley (deposit £1 1s.).

Crayford (KENT).—September 27th. U.D.C. Two electrically driven sewage pumps, with motors, control panels, &c. F. A. N. Turner, engineer, Municipal Buildings (deposit £2 2s.).

Dumfries.—September 28th. County Council. Electrical work at twenty-eight houses at Eaglesfield. County clerk.

Dundee.—September 28th. Housing Department. Electric lighting installation at the Gardner Street housing estate. City quantity surveyor, 21, City Square.

Dunfermline.—September 28th. Town Council. Electric lighting at forty-two houses. Burgh engineer (deposit £1).

Edinburgh.—September 27th. Electricity Department. Medium voltage switchgear for Portobello power station. (September 10th.)

Egypt.—MINIA.—October 5th. Municipal Council. Electric clocks. (T. 19412/37.)*
CAIRO.—October 20th. Ministry of Public Works. Air-conditioning apparatus. (T. 19621/37.)*

Fife.—October 19th. County Council. Electrical work at police station, Earlsferry, Elie. G. Sandilands, County master of works, County Offices, Wemyssfield, Kirkcaldy (deposit £1 1s.).
October 19th. Electric lighting at new police station, Springfield. Particulars from G. Sandilands (deposit £1 1s.), by October 2nd.

Gloucester.—City Council. Electric meters and p.i. cables. (September 17th.)

India.—SIMLA.—October 2nd. Stores Department (Electrical Branch). A.c. and d.c. house service meters. (T. 19308/37.)*
October 7th. Converting plants. (T.Y. 19394/37.)*
NEW DELHI.—October 28th. Stores Department (Electrical Branch). Oil-engine driven generating sets and switchgear. (T. 19535/37.)
October 26th. Twelve months' supply of copper conductors. (T. 19654/37.)*

London.—EAST HAM.—October 11th. Borough Council. Electrical installation at a central clinic and public offices, Barking Road. (September 17th.)
METROPOLITAN WATER BOARD.—November 15th. Eleven electrically driven and two water turbine driven centrifugal pumps, &c., at the Hampton pumping station. Chief engineer, Room 235, 173, Rosebery Avenue, E.C.1 (deposit £2s 2s., to the Comptroller).

Manchester.—September 30th. Town Hall Extension Special Committee. Display fittings for the Electricity Showrooms. F. E. Warbreck Howell, town clerk, Town Hall (deposit £1 1s.).
October 8th. Electricity Committee. High- and low-pressure pipework at the Stuart Street power station and a.c., 15,000-V testing equipment at the Dickinson Street station. (See this issue.)

Middlesex.—September 30th. County Council. Bed and service lifts in the maternity block, Central Middlesex County Hospital, Willesden. (September 10th.)
September 27th. Automatic telephone cables at Shenley Hospital. (September 10th.)
October 4th. Bed lifts in blocks 11 and 12 at Chase Farm, Enfield. (September 10th.)

Midlothian and Peebles.—September 30th. District Asylum, Rosslynlee. One year's supply of electrical fittings. C. L. Addison-Smith. 19. Heriot Row, Edinburgh.

New Zealand.—WELLINGTON.—October 27th. Post and Telegraph Department. Switchboard lamps. (T.Y. 19339/37.)*
October 12th. Public Works Department. Four sets of 110-kV outdoor disconnecting switches. (T. 19340/37.)*
November 16th. Lighting fittings, cable, cable boxes and switchgear. (T.Y. 19431/37.)*
DUNEDIN.—October 20th. Corporation. Distribution transformers. (T.Y. 19430/37.)*

North Kesteven.—September 30th. R.D.C. Wiring of 143 houses. Surveyor, Council Offices, Clasketgate, Lincoln.

Radcliffe.—October 11th. Borough Council. 200-kVA, 300-kVA and 500-kVA transformers. (See this issue.)

Salford.—September 29th. City Council. 6,600/400-V, three-phase power transformers and r.i. cables. (September 17th.)

Sheffield.—October 11th. Electricity Committee. Eleven 11-kV duplicate bus-bar, metal-clad switch units. (See this issue.)

South Africa.—CAPE TOWN.—October 6th. Electricity Supply Commission. Distribution transformers. (T.Y. 19384/37.)*
DURBAN.—October 22nd. Electrical Department. Switchgear. (T. 19524/37.)*
OKAHANDJA.—October 30th. Municipal Electricity Undertaking. Power station and distribution network. (T. 19158/37.)*
PRETORIA.—October 7th. Public Works Department. Electric stoves, ranges, boiling tables, &c. (T. 15154/37.)*
JOHANNESBURG.—October 16th. City Council. Isolating links. (T.Y. 19491/37.)* One year's supply of joint box compound. (T.Y. 19492/37.)*
PORT ELIZABETH.—October 28th. Municipality. Switch units, pillar boxes, kiosks, cable, lighting standards and lamps, &c. (T.Y. 19624/37.)*

Straits Settlements.—SINGAPORE.—October 15th. Municipality. Pumps and electrical equipment for the sewage works. (T.Y. 19172/37.)*

Uruguay.—MONTEVIDEO.—October 27th. State Electricity Supply and Telephones Administration. Switchgear. (T.Y. 19518/37.)*

Wallingford.—October 13th. R.D.C. Three electrically driven sewage pumping plants in connection with the reconstruction of the Didcot sewage works. Particulars from Howard Humphreys & Sons, 17, Victoria Street, London, S.W.1 (deposit £2 2s.), by October 1st.

Walsall.—October 12th. Electric Supply Committee. One three-phase testing equipment. (September 17th.)

Warrington.—October 4th. Electricity and Transport Committee. Cable, earthenware conduits and cable protector slabs and tiles. (September 17th.)

West Riding.—September 27th. County Council. Electric lighting at the new Wombwell Technical Institute. Education officer, County Hall, Wakefield.

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Armadale (LINLITHGOW).—Town Council. Accepted. Electric lighting at the new West Main Street housing estate (£1,410).—R. W. Lawrence.

Australia.—MELBOURNE.—City Council. Accepted. V.i.r. cables.—Henley's. Conduit.—British General Electric Co.
BRISBANE.—City Council. Accepted. Cable.—Enfield Cable Co.; Henley's; Siemens (Aust.) Pty., Ltd.—*Tenders.*

Brighton.—General Purposes Committee. Accepted. Electric tower wagon (£645).—Corporation of Electric Transport, Ltd.
Electricity Committee. Accepted. Coal-handling plant for the Southwick power station (£24,135).—Babcock & Wilcox.

Chester.—Electricity Committee. Accepted. Portable coal conveyor (£168).—C. H. Johnson & Sons.

Elgin.—Accepted. Electrical work in connection with the new extensions and improvements at Gray's Hospital.—W. Barton & Sons.

Glasgow.—Health Committee. Accepted. Electrode circulators and thermal-storage equipment at the extension to the nurses' home, Gartloch Mental Hospital (£6,274).—Bastian & Allen.
Lighting Committee. Accepted. Aerial cable (£1,237).—Raydex Electric Heaters. 1,000 steel poles (£9,375).—Stewarts & Lloyds.

Inverness.—Corporation. Accepted. Electrical work at the South Kessock housing estate.—R. A. Robertson (£470): Edmundson's (£121).

Ipswich.—Electricity Committee. Accepted. Fire extinguishing apparatus at the power station (£655).—Foamite, Ltd.

London. — ISLINGTON. — Electricity Committee. Accepted. Water heaters.—Heatrae, Ltd.; Santon, Ltd.; Aidas Electric.
CAMBERWELL.—Public Service Committee. Recommended. Electric furnace at the Crematorium (£3,043).—G.E.C.
L.C.C.—Wiring and fittings for electric lighting, &c., in blocks 1, 2, 3 (remainder) and 5 of dwellings at Perring Street area, Poplar:

	£		£
Jacob White & Co. Accepted ...	**1,702**	Francis Polden & Co.	1,997
Archibald Meckhonik	1,868	Pinching and Walton	2,013
Samuel Reed & Sons	1,924	Buchanan and Curwen	2,027
Evans and Shea	1,980	F. G. Edey & Co.	2,053

Wiring and fittings for electric lighting, &c., in blocks 1 to 5 of dwellings on the King's Mead estate, Hackney:

	£		£
A. Meckhonik. Accepted ...	***4,642**	Pemberton and Sturgess (Great Britain)	5,372
Jacob, White & Co.	4,869	Gillham and Jones	5,528
Samuel Reed & Sons	4,988	Ilford Electrical Co.	5,983
Buchanan and Curwen	5,083	Houchin, Ltd.	6,178
Bower Engg. Works (Electrical and General)	5,229	Johnson and Tanner	6,403
City Electrical Co.	5,281	Evans and Shea	6,541
G. E. Taylor & Co.	5,336		

* After arithmetical correction.

Wiring and fittings for electric lighting, &c., in seventy-eight houses at Becontree (No. 17 section):

	£		£
E. & C. Champion. Accepted ...	**1,735**	Jacob, White & Co.	2,211
Keeble, Ltd.	1,763	Electrical Installations, Ltd. ...	2,232
Carr Bros.	1,881	W. H. Gaze & Sons	2,278
City Electrical Co.	2,105	Springvale Electrical Co. ...	3,178
F. H. Wheeler & Co.	2,167		

Wiring and fittings for electric lighting, &c., in Paragon school, Southwark, S.E.:

	£		£
Carr Bros. Accepted	**1,839**	Read and Partners	2,011
A. Hawkins & Sons	1,900	Grant and Blake	2,027
Buchanan and Curwen	1,945	G. E. Taylor & Co.	2,060
Blackburn, Starling & Co. ...	1,946	Electrical Installations, Ltd. ...	2,067
A. Meckhonik	1,985	Pinching and Walton	2,116
Francis Polden & Co.	2,010		

Wiring and fittings for electric lighting &c., at Rathfern Road school, Lewisham:

	£		£
Warren Smith & Co. Accepted...	**1,005**	Atozed (Kingston)	1,172
E. and C. Champion	1,143	Buchanan and Curwen	1,233
Archibald Meckhonik	1,166	Francis Polden & Co.	1,246

ST. PANCRAS.—Contracts and Stores Committee. Accepted. A.c. motors to replace existing d.c. motors in connection with the change-over of the supply to four premises in Park Street, Camden Town (£688).—City Electrical Co.

Lowestoft.—Electricity Committee. Accepted. Two 300-kVA transformers (£355).—Electrical Construction Co.

Turriff (ABERDEENSHIRE).—Town Council. Accepted. Electrical installations at the Woodland housing estate.—A. A. Bisset.

Forthcoming Events

Junior Institution of Engineers.—Saturday, September 25th. Visit to the Mogden purification works, West Middlesex drainage, Isleworth. Friday, October 1st. 39, Victoria Street, London, S.W.1. 7.30 p.m. Opening meeting. Social evening and discussions on engineering subjects.

Salford Technical and Engineering Association.—Saturday, September 25th. Royal Technical College, Salford. 7 p.m. "An Outline of the Telegraph." Mr. W. C. Huff.

Birmingham Electric Club.—Monday, September 27th. Grand Hotel, Birmingham. 7 p.m. "Recent Progress in Electric Lighting." Mr. W. J. Jones.

Institution of Electrical Engineers.—Thursday, September 30th. Visit to the Engineering and Marine Exhibition, Olympia.

National Smoke Abatement Society.—Thursday, September 30th, to Saturday, October 2nd. Leeds. Annual conference.

Electrical Power Engineers' Association (*Southern Division*).—Saturday, October 2nd. Holborn Restaurant, London, W.C.1. 5.30 for 6 p.m. Annual dinner.

Notes

Institution of Electrical Engineers

The 1937-38 session of the Institution of Electrical Engineers opens on October 21st, with the inaugural address by Sir George Lee, president. This meeting is followed by "Street Traffic Signals," Mr. F. G. Tyack (November 4th); "Electrification of the Paris-Orleans and Midi Railways," Mr. A. Bachellery (November 18th); "Scientific Activities of the late Sir Charles A. Parsons," Mr. G. Stoney (2nd Parsons Memorial Lecture) (November 25th); "Rural Electrification," Mr. J. S. Pickles (December 2nd); "Electrical Engineering Education," Prof. C. L. Fortescue, Col. H. C. Fraser and Mr. F. H. Clough (December 16th); "Safeguards Against Interruption of Supply," Messrs. H. W. Clothier, B. H. Leeson and H. Leyburn (January 6th); and "The Design of Domestic Electric Cookers," Mr. O. W. Humphreys, and "Electric Cookers for Domestic Purposes," Mr. J. N. Waite (January 20th). The subjects for subsequent meetings will be announced later.

The session of the North Midland Centre opens on Tuesday, October 12th, when Mr. J. G. Craven, chairman, will deliver his address. At meetings during 1937 papers will be read dealing with "The Use of Protective Multiple Earthing and Earth-Leakage Circuit Breakers in Rural Areas," Mr. H. G. Taylor (October 26th); "Modern Systems of Multi Channel Telephony on Cables," Col. A. S. Angwin and Mr. R. A. Mack (November 9th); "Rural Electrification," Mr. J. S. Pickles (November 23rd); and "The Examination and Recording of the Human Electro-cardiogram by Means of the Cathode-Ray Oscillograph," Dr. D. Robertson (December 7th). The annual dinner is to be held on Friday, March 4th, and the annual general meeting on Tuesday, March 29th. All meetings will be held at the Hotel Metropole, Leeds, commencing at 7 p.m.

Birmingham Electric Club

The Birmingham Electric Club's first meeting of the new session will take place on Monday, September 27th, at the Grand Hotel, when a lecture will be given by Mr. W. J. Jones on "Recent Progress in Electric Lighting." This will be followed by "The Development of Air Conditioning Load in the U.S.A.," by Mr. J. C. Chaytor, on October 25th, and on November 22nd, Mr. F. W. Lawton will deal with "The Creation and Development of a Modern Power Station." The annual general meeting is fixed for December 20th. In the new year the opening meeting will be held on January 31st, when the president will deliver his address and on February 28th, a paper will be read on "Electrical Services in a Large Stores," by Mr. O. C. Waygood. The annual dinner is arranged for Friday, March 4th, and on the 28th, Mr. G. H. Watson will deal with "Television." Friday, May 6th, is the provisional date for the annual visit.

Electrical Installations in Cinemas

Mr. N. B. D. Hyde, of the inspection staff of the Liverpool Corporation Electricity Department, in a recent address to the Liverpool Court of the Guild of Projectionists and Technicians, pointed out that the wiring of a theatre or cinema was considerably simplified where a single rate for all services was adopted. Each 15-A socket, he said, should be wired from one way of a distribution box, but up to three 5-A sockets might be wired as a circuit. The cable, however, must be throughout of a gauge sufficient to carry the full load of the final sub-circuit, and in practice the wiring of more than one 5-A socket per circuit introduced difficulty as, if the circuit were fused for more than 5 A, flexibles required to be heavier than necessary for the apparatus. In cinemas, the lighting circuits should be kept separate and the auditorium lighting, if controlled from the operating box, should have a further means of control outside the box. An additional means of illuminating the auditorium was often provided which permitted switching from various positions. He considered that many failures and irregularities were due to interfering unduly with the wiring. If an installation had worked satisfactorily for several months it would probably continue to work satisfactorily for an indefinite period if it were not interfered with

Midland Electrical Engineers' Ball

The annual Midland Electrical Engineers' Ball will be held at the Grand Hotel, Birmingham (Grosvenor Suite), on November 12th under the presidency of Mr. S. T. Allan, Central England engineer, C.E.B., Wake Green Road, Moseley, Birmingham, 13. The chairman is Mr. W. H. Heaton, works manager, General Electric Co., Ltd., Witton, and the hon. secretary is Mr. W. Y. Anderson, 12, Richmond Park, Olton, Birmingham, 27. Applications for tickets should be made to the above or any committee member.

A.M.E.E. (South Wales Branch)

As a preliminary to the official opening of the 1937-1938 session the South Wales Branch of the Association of Mining Electrical Engineers visited the Severn Tunnel pumping station on September 18th. In the absence of Mr. J. V. Harries, branch president, Mr. J. Jones, vice-president, took charge, assisted by Mr. H. J. Norton, branch hon. sec. Splitting up into parties of ten, the visitors, who numbered about sixty, were shown over the pumping station by officials of the Great Western Railway, under the supervision of Mr. D. Miller, the pumping station superintendent.

Accident at Maidstone Power Station

An accident occurred in the Maidstone Corporation generating station on Sunday morning in which Mr. H. A. Haines, technical assistant, and Mr. L. Waterman, foreman electrical fitter, were both seriously burned. The mishap also caused a total shutdown of the supply for nine minutes. In connection with the installation of new distribution switchgear in the generating station it was necessary to disconnect some of the old switchgear for the purpose of dismantling it. In the process an earth wire accidentally touched a "live" part. The damage caused was very small on account of the sensitivity of the trip gear which operated satisfactorily. Both Mr. Haines and Mr. Waterman are detained in hospital.

Appointments Vacant

Mechanical and electrical engineering assistants in the drawing office of the Air Ministry and at R.A.F. aerodromes.

Overhead linesman for Weymouth and Melcombe Regis Electricity Department.

Assistant lady demonstrator for Paisley Electricity Department.

Lady demonstrator for Barnsley Electricity Department.

Assistant sales and consumers' engineer for the Boston and District Electric Supply Co., Ltd.

General clerk for Gillingham Electricity Department.

Mechanical and electrical engineer for the Gold Coast Public Works Department.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

ZAWIERGIE lighting fittings.

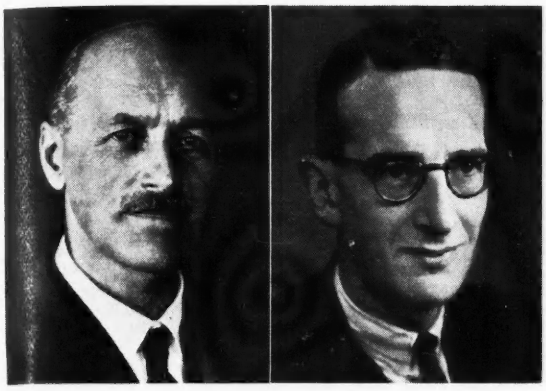
SIMANCO fractional h.p. motors.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. H. G. Baggs has retired after forty-five years' service with Dorman & Smith, Ltd., during the last seven years of which he was chairman. At the last board meeting which he attended, he was presented with a handsome piece of plate by the directors and staff. In preparation for his retirement



Mr. H. G. Baggs **Mr. T. Atherton**

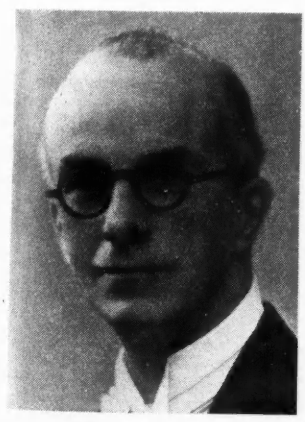
and to facilitate a re-arrangement of the capital and control a new company with the same name was recently registered to carry on the business. The new board consists of **Mr. Thomas Atherton** (chairman), **Mr. Richard Amberton,** M.I.E.E., and **Mr. J. Noel Haworth,** A.C.A. The secretary is **Mr. R. G. Dale.** With the exception of the retirement of Mr. Baggs and the election to the board of Mr. Haworth, there have been no other staff changes.

Mr. R. Jones has left the staff of the Scottish Southern Electric Supply Co. to take up an appointment with the Yorkshire Electric Power Co.

Mr. K. N. Paulin, who has been with Johnson & Phillips, Ltd., since September, 1928, has secured an appointment as assistant executive engineer on the Malakand hydro-electric scheme. He sailed on September 17th in the *Kaiser-I-Hind* for the North-West Frontier Province, India. Mr. Paulin joined Johnson & Phillips, Ltd., as a student from Faraday House, and spent two years in their Switchgear Technical Department. In January, 1931, he was transferred to the Contract Estimating Department on overhead and underground schemes and switchgear and transformer equipments. Latterly he was chief assistant outside engineer on one of the C.E.B. steel tower transmission line contracts.

Mr. J. Ainslie, officer in charge of the Wick radio station, has been promoted to assistant superintendent of the Wireless Branch, Telecommunications Department, St. Martin's-le-Grand, London. He has been in charge at Wick for seventeen years. **Mr. F. J. W. Adams,** who has been second in command at Wick for ten years, succeeds Mr. Ainslie.

Lt.-Comm. A. E. Neal, R.N., Area Officer for the Central England Area of the British Electrical Development Association, has relinquished his appointment owing to illness. Commander Neal went to E.D.A. in 1929 with a distinguished record of Naval service. He joined the Navy in 1890, and during the war he took part in the landing at Gallipoli as an officer serving in H.M.S. *London.*



Lt.-Commander A. E. Neal

Mr. D. J. McClelland has been reappointed a member of the State Electricity Commission of Victoria for five years.

Mr. R. Bond, A.M.I.E.E., chief assistant engineer in the Consumers' and Installation Department of the Swinton and Pendlebury Corporation Electricity Department, has been appointed consumers' engineer and showroom manager with the Stafford Corporation Electricity Department.

The address of **Mr. H. W. Puttick,** chief electrical engineer, East Indian Railway, is, until January 18th, 1938, 105, Clive Street, Calcutta.

Mr. W. Whipp, of Penwortham, is retiring from the position of higher clerical officer in the district manager's office of the Preston Telephone Department at the end of the month. He was transferred to Preston from Blackburn eleven years ago. Mr. Whipp has been in the service for over forty years; he was with the National Telephone Co. before it was taken over by the Post Office in 1912. He received a canteen of cutlery and a clock from the district manager's staff when he left for a short holiday.

Mr. H. L. Reddyhough, station superintendent at the Back-o'-th'-Bank generating station of Bolton Corporation, has resigned, after twenty-five years' service, on his appointment as manager of Barry & Co.'s electric light and power works at Gourepore, Bengal. He leaves for India at the end of October. From 1924 to 1927 Mr. Reddyhough was secretary of the Northern Division and a member of the National Executive Council of the Electrical Power Engineers' Association, and in December last was appointed president of the Manchester Section. His farewell gifts from his colleagues at Back-o'-th'-Bank are a wardrobe trunk, fountain pen, pencil and pipe.

Obituary

Mr. J. W. Howell.—The death occurred recently of Mr. John White Howell, retired chief engineer of the lamp works of the American General Electric Co. The official organ of the American I.E.E. states that Mr. Howell was recognised as one of the most distinguished electrical pioneers in the production of incandescent lamps. Among his achievements were the development of a successful portable voltmeter, a Wheatstone bridge type of potential indicator, and the comparative indicator. He determined for the first time the relation between the life and candle power of an incandescent lamp (1886); introduced a carbonaceous clamp that decreased clamping and filament costs and increased the quality of the lamp (1887); and later made changes to effect an increase in the speed of exhausting the envelope. He improved the Thomson-Houston method of treating carbon filaments, and devised a machine that made great advances in the treating process. He assisted in the design of the first stem-making machine and in the derivation of metalised filaments.

Monsieur C. F. Guilbert.—The death recently occurred in Paris at the age of seventy years of M. Cyrillo F. Guilbert, for many years the assistant director of the French Ecole Superieure d'Electricité.

Mr. J. J. Hutton, partner in A. Higginbotham & Sons, electricians and contractors, of Bradford, died on September 17th at the age of seventy years.

Mr. P. C. Tippett.—The funeral took place on September 11th of Mr. Percy Clifford Tippett, of Wheal Rose, Scorrier. Mr. Tippett, who was chief way-leave officer with the Cornwall Electric Power Co., was forty-eight years of age, and had been ill for several months.

Mr. D. C. Assersohn.—The death occurred at the Southmoor Nursing Home, Bournemouth, on September 12th of Mr. David Conrad Assersohn. Mr. Assersohn, who was sixty-four, was born in Russia. He came to London in his youth and founded the firm of D. Assersohn, electrical engineers and sign makers, of 31, St. Bride Street, E.C. Later he founded the Vitreous Enamelling Works, Acton, and subsequently acquired the firm of George Forrest & Son, electrical fitting manufacturers, of 5, Neville's Court, E.C.4.

An Australian Propaganda Film

THE production of a full-length feature film designed to convey electrical propaganda through the medium of a dramatic story-scenario is being considered by various supply undertakings in New South Wales, states *Erda.* It is intended that the film shall be released through outer suburban and country theatres, electrical demonstrations, exhibitions, educational associations, church and social bodies, clubs and schools. The General Committee of the Electrical and Radio Development Association, which is handling the matter on behalf of trade interests, has recently received a letter, signed by Mr. H. R. Forbes Mackay (general manager, Sydney County Council Electricity Department) and Mr. H. G. Conde (chief engineer, Electric Light and Power Supply Corporation, Ltd.) setting out the facts of the proposal, which are that the film should, in dramatised story form with an attractive human theme, demonstrate and advocate the use of ranges, water-heaters, refrigerators, electric fires, washing machines, vacuum cleaners, laundry equipment, mixers, radio, clocks, toasters, irons, jugs and domestic electrical equipment generally. The showing time will be approximately 40 min., and the estimated cost of completing the film is £5,000, of which electricity supply undertakings are prepared to contribute £2,500. It is considered that the balance of £2,500 should be subscribed by the electrical and radio industry generally. So far as other States are concerned, the practicability of copies of the film being available for circulation should be of considerable interest.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

South London Factors, Ltd.—Private company. Registered September 17th. Capital, £3,000. Objects: To carry on the business of radio engineers, gramophone manufacturers and dealers, dealers in radio components and sets, radio gramophones, electrical fittings, &c. The directors are: C. L. Elliott and W. N. James, both of 632/634, Wandsworth Road, S.W. Registered office: 54, Chancery Lane, W.C.2.

Fred G. Alden, Ltd.—Private company. Registered September 17th. Capital, £15,000. Objects: To carry on the business of heating, ventilating and electrical engineers, &c. The directors are: F. G. Alden (permanent governing director), Bagley Wood House, Oxford, and two others. Registered office: 7, New Road, Oxford.

Cook & Co. (Leeds), Ltd.—Private company. Registered September 13th. Capital, £1,890. Objects: To carry on the business of automobile electrical engineers, motor factors, &c. The directors are: A. J. Harvey, 84, Blake Road, New Southgate, N.11; Mrs. M. Dobson, Gordon House, Embsay, near Skipton; and R. E. Jones, 87, Dartmouth Street, Leeds, electrical engineer. Secretary: M. Dobson. Registered office: 38, Cookridge Street, Leeds.

Electrophonic Organ Co., Ltd.—Private company. Registered September 13th. Capital, £5,500. Objects: To enter into an agreement with J. W. Walker & Sons, Ltd., A. H. Midgley and A. M. Midgley and Midgley Harmer, Ltd., and to carry on the business of manufacturers, importers and exporters of, agents for and dealers in electrical and wireless apparatus of all kinds, gramophones, telephones, &c. The directors are: F. P. Walker, R. H. Walker and A. C. C. Thorne, addresses not stated. Solicitors: Stanley Johnson & Allen, 426, Salisbury House, E.C.2. Registered office: Braintree Road, Ruislip, Mdx.

Trump Electrical Mat Co., Ltd.—Private company. Registered September 15th. Capital, £100. Objects: To carry on the business of manufacturers and repairers of and dealers in electrically heated mats and floor coverings, &c. The subscribers are: E. M. Sawyers, 2a, Leechcraft Avenue, Sidcup, Kent; and E. G. Spiller, 4, Grey Villas, Russell Road, Horsell, Surrey. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, W.C.2.

Bannister, Son & Co. (Croydon), Ltd.—Private company. Registered September 14th. Capital, £7,000. Objects: To acquire the business of a radio and electrical engineer and music dealers carried on by F. W. Bannister at 225, Lower Addiscombe Road and 156, Cherry Orchard Road, Croydon. The permanent directors are: F. W. Bannister, 81, Shirley Road, Croydon; and K. W. Bannister, 4, Cecil Court, Addiscombe Road, Croydon. Secretary: John A. Cousins, F.L.A.A., 40, Russell Square, W.C.1.

Aibleisi Eireannaca, Teoranta.—Private company. Registered in Dublin September 11th. Capital, £25,000. Objects: To carry on in the Irish Free State or elsewhere the business of electrical engineers, electricians, &c. The directors are: S. Hayes, Thurles, Co. Tipperary; and J. B. Hamill, Ard Ronan, Dromiskin, Co. Louth.

Xana, Ltd.—Private company. Registered September 14th. Capital, £1,000. Objects: To acquire and exploit inventions of electric lamps and all other electrical equipment, and to carry on the business of manufacturers of electric lamps, apparatus and appliances, &c. The directors are: A. Yentchmen, 75, Chardmore Road, Upper Clapton, N.16; and M. F. Goder, 25, Greencroft Gardens, Hampstead, N.W.6. Registered office: 1, Hatton Garden, E.C.1.

Midwest Radio (Manufacturing) Co., Ltd.—Private company. Registered September 14th. Capital, £100. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in radio, television, electrical and mechanical apparatus, &c. The directors are: G. Hayes and Emily Hayes, both of 16, Old Town, Clapham, S.W.4 (both directors of Midwest Radio, Ltd.). Registered Office: 16, Old Town, Clapham, S.W.4.

Gold Seal Electrolyte, Ltd.—Private company. Registered September 14th. Nominal capital, £15,000. Objects: To acquire rights from A. Fuchs and E. Brust in respect of "Gold Seal" electrolyte, and any secret processes, patents and other similar protections in connection therewith; and to carry on the business of manufacturers of and dealers in chemical compositions, fluids and materials used in connection with electric power, traction and storage batteries, wireless apparatus and electrical plant generally; electrical engineers, &c. The first directors are: B. Laing and A. Fuchs (both permanent). Solicitors: Linklaters & Paines, 2, Bond Court, Walbrook, E.C.

Ismay Zeros, Ltd.—Private company. Registered September 13th. Nominal capital, £5,000. Objects: To carry on business as mechanical engineers, manufacturers of or dealers in refrigerators or other machinery or apparatus for cooling or freezing food, liquids or other substances; metal workers or founders, woodworkers, cabinet makers, &c. The subscribers are: J. Ismay, Sterling House, Sterling Works, Dagenham; and W. Normelli, Lundby Gard, Hallsta, Sweden. Registered office: Zeros Works, Dagenham, Essex.

Returns of Electrical Companies

Marconi's Wireless Telegraph Co., Ltd.—Capital, £4,000,000 in 3,250,038 ordinary shares of 10s., 499,935 ordinary shares of £1, 3,250,092 shares of 10s. and 250,000 7 per cent. cumulative participating preference shares of £1. Return dated May 20th, 1937. 3,250,038 10s. ordinary, 395,114 £1 ordinary and 250,000 preference shares taken up. £1,797,484 10s. paid on 3,094,969 ordinary of 10s. and 250,000 preference shares. £472,648 10s. considered as paid on 155,069 ordinary of 10s. and 395,114 ordinary of £1. Mortgages and charges, nil.

Wireless-Electric (Wholesale), Ltd.—Particulars filed of £500 debentures authorised September 7th, 1937, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued, and ranking *pari passu* with debentures issued September 27th, 1933.

Calcutta Electric Supply Corporation, Ltd.—Satisfaction, in full on August 26th, 1937, of trust deed dated June 26th, 1922, and registered July 13th, 1922, securing £500,000 5½ per cent. second mortgage debentures.

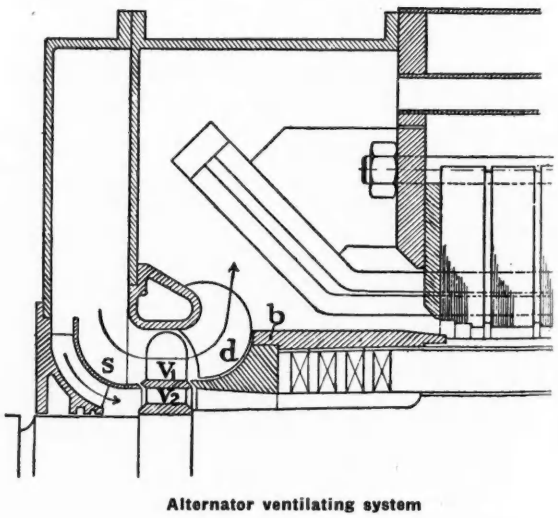
Manchester Armature Repair Co., Ltd.—(a) Mortgage on leasehold property known as The Hathershaw Iron Works, Oldham, dated September 8th, 1937, to secure £2,000. Holders: M. A. R. (Holding) Co., Ltd., 90, Deansgate, Manchester. (b) Mortgage on various plots of land fronting Hadfield Street.

Ventilation of Turbo-Alternators

AN article by Dr. J. Kucera (Prague) in the *Revue Générale de L'Electricité* deals with the problems of distributing ventilating air in high-speed turbo-alternators in such a way as to avoid hot spots and, at the same time, to minimise ventilation losses. As windage losses vary with the fourth power of the diameter of the rotor an inducement is offered to keep the diameter as small as possible, but special arrangements are then necessary to maintain adequate circulation of air through the rotor.

The reduced pressure maintained at the intake of the usual type of radial fan is apt to divert to the stator air which ought to flow through the rotor ducts. This is avoided by the double fan shown in the accompanying illustration, the upper and lower blades v_1, v_2 being designed to suit the stator and rotor air circuit respectively, and the partition *s* preventing the outer fan from robbing air flow to the rotor. Diffusor blades *d* improve the distribution of air to the stator. The efficiency of fans of this type is claimed to exceed 60 per cent., compared with 30 to 40 per cent. for a plain radial fan.

The length of the air paths can be reduced by dividing the air cooler into two equal sections, which may conveniently be mounted above the generator at each end, warm air leaving the machine at the centre and cooled air entering at each end. Suitably curved spacing strips in the stator ducts, with curved dippers protruding into the air-gap, promote the flow through the stator of air entrained in the air gap by the rotation of the rotor. The net effect of these several expedients, in conjunction with general attention to the reduction of air velocity in those parts of the ventilating circuit where little or no cooling is required, is claimed to be a reduction of 40 per cent. or more in the ventilation losses compared with those arising from customary designs.



Alternator ventilating system

Hathershaw, Oldham, and buildings erected thereon known as "Hathershaw Iron Works," dated September 7th, 1937, to secure £1,000. Holders: O. L. Spedding, 34, London Road, Manchester.

Wessex Service Factors, Ltd.—The nominal capital has been increased by the addition of £5,000 beyond the registered capital of £3,000. The additional capital is divided into 4,000 7 per cent. preferred ordinary and 1,000 ordinary shares of £1.

West Gambrian Power Co., Ltd.—Capital, £500,000 in £1 shares. Return dated July 12th, 1937. 440,000 shares taken up. £439,066 5s. paid (£1 on 439,066 and 5s. on 1 share), £933 15s. considered as paid (£1 on 933 and 15s. on 1 share). Mortgages and charges nil.

Midland Electric Wire Co., Ltd.—Capital, £5,000 in £1 shares. Return dated June 24th, 1937. All shares taken up. £5,000 paid. Mortgages and charges nil.

Siemens Brothers & Co., Ltd.—Capital, £3,000,000 in £2,450,000 ordinary stock and £550,000 10 per cent. cumulative preference stock in units of £1. Return dated June 4th, 1937. All stock taken up. £3,000,000 paid. Mortgages and charges nil.

Wade & Mills, Ltd.—Capital, £500 in £1 shares. Return dated July 8th, 1937. All shares taken up. £500 paid. Mortgages and charges nil.

Comet Radio Services, Ltd.—The nominal capital has been increased by the addition of £9,000 beyond the registered capital of £1,000. The additional capital is divided into 1,500 ordinary and 7,500 6 per cent. cumulative redeemable preference shares of £1.

Trevor Fry, Ltd.—Issue on September 8th, 1937, of £100 debentures, part of a series already registered.

Petbow, Ltd.—Satisfaction in full on February 18th, 1935, of debenture dated February 14th, 1933, and registered February 27th, 1933, securing all moneys due or to become due from the company to chargee.

McKay (Harrow), Ltd.—The nominal capital has been increased by the addition of £500 in £1 ordinary shares beyond the registered capital of £500.

Brunwee, Ltd.—The nominal capital has been increased by the addition of £7,500 beyond the registered capital of £15,000. The additional capital is divided into 7,500 7½ per cent. cumulative redeemable preference shares of £1 each. At September 10th, 1937, all the shares had been issued, of which the Philco Radio and Television Corporation of Great Britain, Ltd., held 7,500 preference and 7,800 ordinary.

Electricars, Ltd.—Deposit on August 25th, 1937, of deeds of land, buildings and hereditaments at Yardley Wood, Hall Green, King's Norton, Birmingham, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

R. Darbyshire, Ltd.—Equitable charge on certain hire-purchase agreements dated September 3rd, 1937, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £1,000.

Vacuums, Ltd.—Issue on August 19th, 1937, of £4,850 debentures, part of a series already registered.

Berry's Electric (1928), Ltd.—Capital, £225,000 in 450,000 shares of 10s. Return dated July 16th, 1937. 282,007 shares taken up. £1,003 10s. paid on 2,007 shares. £140,000 considered as paid on 280,000 shares. Mortgages and charges, £54,400.

Electric Development and Securities Trust, Ltd.—Capital, £850,000 in £1 shares. Return dated July 26th, 1937. All shares taken up. £426,890 10s. paid (£1 on 114,401, 15s. on 149,986, and £2 on 100,000 shares). £523,109 10s. considered as paid (£1 on 485,613 and 5s. on 149,986 shares). Mortgages and charges, £750,000.

Beaconectric, Ltd.—Capital, £5,000 in 1,000 preference and 4,000 ordinary shares of £1. Return dated May 31st, 1937. 250 preference and 3,300 ordinary shares taken up. £1,350 paid. £2,200 considered as paid. Mortgages and charges, nil.

Midland Electric Installation Co., Ltd.—Capital, £10,000 in £1 shares. Return dated July 16th, 1937. 6,502 shares taken up. £1,502 paid. £5,000 considered as paid. Mortgages and charges, nil.

City Notes

The Ransome & Marles Bearing Co., Ltd., reports a net profit for the year ended June 30th, after making provision for depreciation and taxation, of £166,351, as compared with £116,809 in the preceding year. It is proposed to pay a final ordinary dividend of 12½ per cent., less tax, making 20 per cent. for the year (against 15 per cent), and to place £80,000 to reserve, leaving £46,742 to be carried forward. It is further proposed to increase the capital by £200,000 to £700,000 and also to capitalise £125,000 of reserve and issue this amount to shareholders in the form of a bonus of one fully-paid share for every four held. This will bring the issued capital to £625,000. The remaining balance will be issued as and when the board considers it is required to provide for further capital expenditure. At the annual meeting on October 8th a resolution will be submitted providing that the directors shall be entitled in future to receive, in addition to the fixed amounts of £500 per annum to the chairman and £300 to each other director, an amount equal in the aggregate to 5 per cent. of the dividend paid on the ordinary shares, the maximum amount of this additional remuneration to be £3,000 a year.

The United River Plate Telephone Co.—The *Financial Times* reports that an Argentine banking group headed by Credito Industrial y Commercial Argentino (representing the Bemberg interests) and Bracht & Co., is offering for public subscription, in Buenos Aires, Argentine pesos 30,000,000 (£1,860,000) 5½ per cent. debentures of the United River Plate Telephone Co. of Buenos Aires. The issue price is 94 per cent. These bonds are part of a total issue of £3,700,000, which is redeemable in 1962 by means of a cumulative sinking fund of one per cent. per annum. Interest on the 5½ per cent. debentures is subject to a 5 per cent. revenue tax payable in Argentina, but they are free of British income tax. An issue of Swiss fr. 40,500,000 (£1,840,000) 5 per cent. debentures was made by the company in July last.

Stothert & Pitt, Ltd., report a net profit for the year ended June 30th, including the dividend receivable from the subsidiary company, of £65,218, as compared with £34,726 in the previous year. From this is deducted £14,200 placed to tax reserve, leaving £51,018, plus £1,178 brought in. Reserve receives £12,500, the pension fund £1,500, and an ordinary dividend (including additional capital subscribed in April, 1937) at the rate of 10 per cent. is paid for the year, and a bonus of 2½ per cent. The amount carried forward is £11,741.

Lancashire Dynamo & Crypto, Ltd., has announced an interim dividend of 7½ per cent. on ordinary capital of £387,000, as compared with a dividend of 5 per cent. on capital of £260,000 a year ago. The directors state that the total of unexecuted orders on hand considerably exceeds the amount at the commencement of the year, which was mentioned at that time as being the highest for many years.

Ransomes & Rapier have declared an interim dividend of 2½ per cent., tax free. This is at the same rate as last year, but is paid on increased capital, 59,000 shares having been issued in July last.

The Carrier Engineering Co., Ltd., is again paying a dividend of 50 per cent., less tax, for 1936-37. During the year the ordinary capital was increased from £75,000 to £150,000.

The Midland Electric Corporation for Power Distribution is again paying an interim dividend of 3 per cent.

Associated Fire Alarms is paying a dividend of 6 per cent. for the year ended June 30th (against 5 per cent.).

Murex, Ltd., has declared a final ordinary dividend of 10 per cent. and a cash bonus of 2½ per cent., both less tax, making a total distribution for the year of 20 per cent., less tax. This is payable on the increased capital of £1,000,000 and compares with a total of 25 per cent. for the previous year on capital of £553,500.

The British Aluminium Co., Ltd., is resuming interim dividends on the ordinary shares with a dividend of 4 per cent., actual, less tax. The last interim dividend was for the year 1930, when 4 per cent. was distributed. The first and final declaration for 1936 was 10 per cent.

Brilliant Signs, Ltd., is paying an interim dividend of 4 per cent., less tax, on the ordinary shares on account of the year ending December 31st.

The Midland Counties Electric Supply Co., Ltd., is maintaining the interim ordinary dividend at 2½ per cent.

Stocks and Shares

TUESDAY EVENING.

ANOTHER heavy fall in the values of American stocks and shares caused renewed anxiety in Stock Exchange markets. The course of prices assumed the proportions of a slump. This was hastened by a variety of causes, including a pause in the progress of U.S.A. trade, and the effect of restriction upon business placed by regulations from Washington, aimed at speculation of any sort. Practically all sections of the American market participated in the weakness, utility as well as railroad shares giving way heavily. The consequence in London has been to bring about realisations of stocks and shares whose holders have substantial obligations to meet in the American market.

Spasms of forced liquidation occur every now and then, with the result that investment confidence is shaken, and restraint is placed upon enterprise which otherwise might be induced by the excellent achievements of domestic industrial companies, to employ money in the Stock Exchange markets. A rally in American prices on Tuesday in this week helped to spread a firmer tendency throughout the House as a whole.

The Cautious Capitalist

Further explanation of the investor's attitude towards stocks and shares at the present time is to be found in the changing outlook in regard to the future. This time last year and for many months previously people with money were anxious to use it in the purchase of securities of companies whose current progress was generally expected to be accelerated as time went on. Accordingly, investment brought ordinary shares of the front-rank industrial companies up to a price level at which, in a good many cases, the yield on the money became less than that offered by purely gilt-edged securities. The yield on perfectly sound preference shares was for a time, and in a number of cases, higher than that offered by the ordinary shares in the same company.

Investment Tendencies

Owing to the changed conditions just mentioned, the pendulum has swung far over in the other direction. Instead of looking for expanding profits and increasing trade, to-day's investor is more apt to argue that, although profits at the present time may be exceedingly good and the immediate prospect pleasant enough, yet it is well to look ahead for a year or so and to ask whether such prosperity can be maintained. This contention is one that is heard nowadays on all hands. No doubt it is due in some measure to the psychological effect of the falling values brought about by upheavals in the Far East, in South-Western Europe, and in the U.S.A. It will be duly corrected when market conditions return to a state of affairs more approaching the normal. The cynic will, no doubt, retort that the longest memory is unable to recall any time when Stock Exchange members admitted that normal conditions did prevail.

Electricity Supply Shares

No changes of consequence have taken place in the ordinary and preference shares of the leading home electricity companies. This department has managed to escape, so far, the effects of the liquidation to which reference has already been made. The London shares show a steadiness which implies the ready response of prospective buyers to take what few shares come to market. London Power 5 per cent. debenture stock at 105½ has lost the point it gained last week. In the overseas group, Calcutta Electrics are dull at 43s. This brought down the new shares to 42s. 9d. Perak Hydro Electrics are easier at 26s. Tokio Electric sixes, after their drop to 61, have recovered to 65½.

The Midland Electric Corporation for Power Distribution has declared its usual interim dividend of 3 per cent. This is payable on October 13th. The full dividend for last year was made up to 9 per cent. and at the present price of the shares, 2½, the yield comes to £4 4s. 8d. per cent. On Midland Counties, at 38s., the return is practically the same. This company paid 8 per cent. for 1936.

"Amalgamation"

Compulsory amalgamation of municipal electricity supply undertakings is by no means relished by all parties concerned, although the big companies are assumed to have agreed, in effect, to support the policy in the McGowan Report. On the other hand, some of the smaller municipal undertakings are strongly opposed to it. At a recent meeting in Manchester their committee decided to request the Ministry of Transport to meet a deputation on the subject. The argument is that the objects of the McGowan Report could be achieved better by allowing local authorities to retain their undertakings.

Cable and Wireless

The Board of Trade returns provide evidence of the manner in which industry is expanding in many directions. The warning is occasionally raised at company meetings, and elsewhere, that the country is depending too much upon its internal business and not laying sufficient stress upon the need for increasing overseas activities. The Cable and Wireless traffic index number for August lends no support to the caution. The index figure of 73 is the highest reported for August in seven years. In August, 1930, the index stood at 82; last year it was 69. This helps the average for the two-thirds of the calendar year that have already passed, bringing the traffic index for the eight months to 80.4, as against 71 for the similar period in 1936. The figures were received in the market with satisfaction, but "general conditions" proved too much for the prices of the stocks. The ordinary shed 3 points and the preference is 1 down at 75½ and 103 respectively.

Marconi Marines have further fallen to 35s. 9d. Great Northerns are £1 easier at 41. Oriental Telephones have gone back to £3. There can be little doubt that if a more normal state of affairs obtained the prices of cable stocks would be attracting just now the attention to which expansion of the industry entitles them.

Manufacturing and Equipment

Prices of the good-class ordinary shares in various industrial markets have come down to prices that offer temptation to the buyer who rightly concludes that he is entitled to a living rate of interest on his money, even from ordinary shares in front-rank companies. The quotations in the final group of share tables in the adjoining column are worth studying. They show that after the fall which has taken place a number of the shares in the leading companies can be bought at prices which pay moderately well on the money. General Electric ordinary, British Insulated, Associated Electrical and Johnson & Phillips are amongst the shares that afford a reasonable rate of interest at the current quotations, having due regard to the prospect of increased distributions by-and-by.

Of the more speculative descriptions, a fall of two points in Brush ordinary has reduced the price to 42½. Crompton Parkinson ordinary are once more ½ lower, at 2⅝. Various shares in the radio section have fallen to prices that give a return of approximately 10 per cent. on the money.

Lancashire Dynamo

Satisfaction with the announcement of a 7½ per cent. interim dividend on Lancashire Dynamo & Crypto ordinary failed to prevent the shares from following the general course of prices. Allowing for deduction of the dividend, the quotation stands 1s. lower on the week at 3 1/16. This latest distribution compares with 5 per cent. at the same time last year, when, moreover, the ordinary capital was £127,000 smaller than it is now. The company's dividend record makes impressive reading. The ordinary dividend was doubled, to 5 per cent., in 1934, and doubled again in each of the two following years, making last year's distribution 20 per cent. Shareholders have since been offered new shares on profitable terms, and are now given an earnest of a still further increase in this year's total distrbiution on the larger number of shares. The company's report that the works are very fully employed seems, under the circumstances, almost redundant. At the present price the shares yield £5 12s. 4d. per cent. on the basis of last year's dividend; assuming, as some people do, that this year's total will be made up to 25 per cent., the return would be almost exactly 7 per cent. on the money.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Dividend. Previous.	Dividend. Last.	Price Sept. 21.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	67/6	—	4 9 0
City of London	1	7½	7½	34/6	—	4 7 0
Clyde Valley	1	7	8	40/6	—	3 19 0
County of London	1	10½	10½	49/-	—	4 5 9
Edmundson's 7% Pref.	1	7	7	33/6	—	4 3 7
Do. Ord.	1	8	9	39/-	—	4 12 4
Elec. Dis. Yorkshire	1	9	9	41/-	—	4 7 10
Elec. Fin. and Securities	1	12½	12½	2⅜	—	4 13 0
Elec. Supply Corporation	1	11	12	52/6xd.	+6d.	4 11 5
Lancs Light and Power	1	7½	7½	33/6xd.	—	4 9 7
Lond. Assoc. Electric	1	—	7	31/3	—	4 9 6
London Electric	1	7	8	35/6	—	4 10 2
London Power Deb. Red.	Stock	5	5	105½	−1	4 14 9
Metropolitan	1	10	10	46/-	—	4 7 0
Midland Counties	1	7½	8	38/-	—	4 4 8
Mid. Elec. Power	1	8	9	2½xd.	+6d.	4 4 8
North Eastern Electric Ordinary	1	6	7	32/6	—	4 6 2
Do. 7% Pref.	1	7	7	34/-	—	4 2 4
Northampton	1	10	10	45/9	−6d.	4 7 2
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	49/3	—	4 1 2
Do. do. 6% Pref.	1	6	6	30/6	—	3 18 8
Scottish Power	1	8	8	37/6xd.	−6d.	4 5 4
South London	1	7	7	32/-	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/-	—	6 10 5
Yorkshire Elec.	1	8	8	39/6	—	4 1 1

Public Boards.

Central Electricity, 1950–70	Stock	5	5	112½	—	4 9 0
Do. 1955–75	„	5	5	115	—	4 7 0
Do. 1951–73	„	4½	4½	109	—	4 2 7
Do. 1963–93	„	—	3½	97½	—	3 11 10
London Elec. Trans. Gtd	„	—	2½	88	+2	2 16 10
London & Home Counties, 1955–75	„	4½	4½	111	—	4 1 1
London Passenger Transport, A	„	—	4½	113½	—	3 19 4
Do. do. B	„	—	5	117½	—	4 5 1
Do. do. C	„	4	4	79	−2	5 1 3
West Midlands Joint Elec. 1948–68	„	—	5	110½	—	4 10 8

Telegraph and Telephone.

American Tel. & Tel.	$160	9	9	162½	—	5 10 9
Anglo-Am. Tel. Pref.	Stock	6	6	120	−1½	5 0 0
Do. Def.	„	1½	1½	29½	—	5 1 8
Cable & Wireless 5½% Pref.	„	4½	5½	103	−1	5 6 9
Do. Ord.	„	—	—	75½	−3	—
Do. Income	„	—	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	16⅞	—	3 5 8
Do. do. Pref.	10	6	6	14½	—	4 5 9
Great Northern Tel.	10	20	20	41	−1	4 17 7
Marconi-Marine	1	10	7½	35/9	−6d.	4 3 9
Oriental Telephone Ord.	1	12*	12*	3	−⅛	4 0 0

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	5/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	18½	−2	—
British Electric Traction Def. Ord.	„	5	5	1100	+25	—
Do. do. Pref. Ord.	„	8	8	168	—	4 15 5
Brazil Traction	$100	40 cts.	50 cts.	21½	−1	—
Brit. Columbia Elec. Rly. Pfd.	Stock	5	5	105½	—	4 14 9
Mexican Light Common	$100	Nil	Nil	2	—	—
Do. 1st Bonds	$500	5	5	33	−2	—
Victoria Falls Ord.	1	20	12	62/6	−⅛	3 16 10
West Riding	1	6½	10	42/6xd.	+6d.	4 14 1

Manufacturing Companies.

Aron Electricity Ord.	1	15	15	2½	—	6 0 0
Assoc. Elec. Ord.	1	8	10	45/-	−2/-	4 9 0
Do. Pref.	1	8	8	37/6	—	4 5 3
Babcock & Wilcox	1	8	10	46/3	—	4 6 7
British Aluminium Ord.	1	7½	10	51/3	−2/3	3 18 0
British Insulated Ord.	Stock	20	20	4 11/16xd.	—	4 5 6
Brush Ord	Stock	Nil	Nil	42½	−2	—
Callender's	1	15	15	4⅝	−⅛	3 5 0
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/-	12½	12½	2 5/16	−1/16	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	2	—	5 0 0
Enfield Cable Ord.	1	25	25	5½	+⅛	4 11 0
English Electric	1	Nil	Nil	33/-	−1/6	—
Do. do. Pref.	1	6½	6½	26/6xd.	—	4 18 1
Ericsson Tel.	5/-	20	25	2½	−⅛	2 10 0
Ever Ready	5/-	35	45	30/-	−9d.	7 10 0
Ferranti Pref.	1	7	7	27/6	—	5 1 10
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	81/-	−2/-	4 6 8
Henley's	5/-	30	15	19/6	—	3 17 0
Do. 4½% Pref.	1	4½	4½	1½	—	4 0 0
India-Rubber Pref.	1	5½	5½	21/3xd.	+6d.	5 3 6
Johnson & Phillips	1	7½	10	43/9	−1/8	4 11 6
Lancashire Dynamo	1	10	20	3 5/16xd.	−1/-	5 12 4
Siemens Ord.	1	6	7½	33/3	—	4 10 3
Telegraph Construction	£1	Nil	7½	2 5/16	−⅛	2 18 7

*Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1935

32945. "Deflecting means for cathode-ray tubes." M. Bowman-Manifold. November 27th, 1935. (471103.)

35300. "Telegraphic printing-machines or teleprinters, typewriters or like machines." R. A. Goodman, J. A. Collingwood and Western Union Telegraph Co. December 20h, 1935. (470845.)

35346. "Circuit arrangement for teleprinter exchange systems." C. Lorenz Akt.-Ges. December 21st, 1934. (470840.)

1936

1806. "Method of manufacturing permanent magnets." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 4th, 1935. (471051.)

2150. "Illuminatng devices." Claude-General Neon Lights, Ltd., and C. Higgins. January 23rd, 1936. (470853.)

2159. "Protective devices for electrical apparatus and particularly transformers, switchgear, and the like, of the oil-immersed type." J. V. Beaumont, A. W. Tomlinson and Hackbridge Electric Construction Co., Ltd. January 23rd, 1936. (470965.)

2302. "Rubbing electric contact devices." English Electric Co., Ltd., and W. Nelson. January 24th, 1936. (471106.)

2585. "Mesh screens for use in television or like transmitting tubes." Marconi's Wireless Telegraph Co., Ltd. January 30th, 1935. (471109.)

5388. "Electrodes for electric furnaces." Akt.-Ges. für Stickstoffdunger. February 22nd, 1935. (471062.)

5395. "Induction motors." A. Walsh and Metropolitan-Vickers Electrical Co., Ltd. February 22nd, 1936. (471113.)

5490. "Television receivers." Baird Television, Ltd., and L. R. Merdler. February 24th, 1936. (470920.)

5491. "Electrical resistances." Baird Television, Ltd., and L. R. Merdler. February 24th, 1936. (470921.)

5492. "Television and like systems." Baird Television, Ltd., and D. M. Johnstone. February 24th, 1936. (470922.)

5503. "Electric-discharge devices." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). February 24th, 1936. (471064.)

5540. "Wireless receiving apparatus." J. Robinson. February 24th, 1936. (471065.)

5549. "Alternating-current generator arrangements for arc-welding purposes." Siemens-Schuckertwerke Akt.-Ges. February 23rd, 1935. (Cognate application 5550/36.) (470927.)

5636. "Manufacture of electrical rectifiers of the dry surface content type." Westinghouse Brake and Signal Co., Ltd. October 23rd, 1935. (470973.)

5686. "Method of imparting angular motion to a beam of light for scanning purposes for television and the like." Scophony, Ltd., and G. Wikkenhauser. February 26th, 1936. (471066.)

5865. "Electric and other cables, hose pipes, and the like." A. W. Williams. February 27th, 1936. (471122.)

5887. "Photo-electric devices and electric contact rectifiers of the barrier layer type." General Electric Co., Ltd., W. A. Johnson and H. C. Turner. February 27th, 1936. (471157.)

5920. "Flexible multi-core electric cables." Pirelli-General Cable Works, Ltd., and J. L. Bishop. February 27th, 1936. (470862.)

5933. "Modulated carrier-wave transmitters." Marconi's Wireless Telegraph Co., Ltd., E. Green and N. H. Clough. February 27th, 1936. (471128.)

5934. "Electric cables." Marconi's Wireless Telegraph Co., Ltd., and B. J. Witt. February 27th, 1936. (471129.)

6625. "Electric fuses." C. W. Cox. March 5th, 1936. (470866.)

10834. "Lamp more particularly adapted as a forehead-lamp for doctors' use." J. Everhards. April 15th, 1936. (471076.)

11212. "Indicators for electric switches and the like." H. B. Prentice. April 20th, 1936. (470874.)

11260. "Electric circuit-breakers." A. West & Co., H. H. Matthews and J. E. Jones. April 20th, 1936. (470875.)

17812. "Fluid-flow electric switches." British Thomson-Houston Co., Ltd. June 26th, 1935. (471079.)

20476. "Mesh screens for use in television or like transmitting tubes." Marconi's Wireless Telegraph Co., Ltd. January 30th, 1935. (Divided out of 2585/36.) (471137.)

23050. "Commutators for dynamo-electric machines." Siemens-Schuckertwerke Akt.-Ges. August 21st, 1935. (Cognate applications 23051/36 23052/36.) (470944.)

23733. "Tuning arrangements for oscillatory electric circuits." L. L. De Kramolin. August 29th, 1935. (Cognate application 23734/36.) (470945.)

25246. "Electronic apparatus for television systems and the like." Corning Glass Works. July 18th, 1936. (470885.)

27457. "Pressure-operated star-delta controller for electric motors driving gas compressors. Hundt and Weber Ges. October 11th, 1935. (471085.)

29450. "Telephone pay-stations." Telephon-Apparat-Fabrik A. Zwietusch & Co., Ges. March 14th, 1936. (470891.)

29459. "Fluid-flow electric switches." British Thomson-Houston Co., Ltd. October 29th, 1935. (471087.)

32303. "Electric tumbler switches." G. E. Marr. November 25th, 1936. (470892.)

32593. "Photographic or kinematographic cameras having photo-electric exposure meters. Zeiss Ikon Akt.-Ges. November 28th, 1935. (Cognate applications 32594/36 and 32595/36.) (471021.)

34185. "Dielectric materials." British Thomson-Houston Co., Ltd. December 12th, 1935. (470897.)

1937

2445. "Thermally operated fire-alarm apparatus." Compagnie des Téléphones Thomson-Houston. February 29th, 1936. (470902.)

3701. "Electric arc convertors." E. Marx and H. J. Schmiedel. February 6th, 1936. (470904.)

7546. "Manufacture of electric lamps." British Thomson-Houston Co., Ltd. March 13th, 1936. (471099.)

8940. "Electrical contact pins." E. Kleinmann and A. Mendel. March 27th, 1936. (471100.)

22354. "Television or like transmitting tubes." Marconi's Wireless Telegraph Co., Ltd. January 30th, 1935. (Divided out of 471109.) (471149.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 15th.

Vaporzone. No. 573097. Class 6. Electrical machines for producing and mixing steam and vapour for use in air-conditioning.—Carl Ronzi, Zurich, Switzerland (British representative, S. Sokal, 1, Great James Street, W.C.1).

Velox (lettering and design). No. 577872. Class 6. Electric vacuum cleaning machines, electric hand drying machines, and electric floor polishing machines.—Velox Electric, Ltd., Stanton House, 7, High Road, Wood Green, N.22.

Tropex. Nos. 573097 and 578026. All goods in Classes 8 and 13.—The Tropex Battery Co., Ltd., Copenhagen, Denmark (British representatives, Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2).

Ever Ready. No. 579288. Class 8. Radio receiving sets, radiogramophones, aerials for use with radio apparatus, wave filters, radio valves, rectifying valves, amplifying valves, and frequency-changing valves.—The Ever Ready Co. (Great Britain), Ltd., Ever Ready Works, Hercules Place, Holloway, N.7.

Philivisor. No. 579127. All goods in Class 8.—Philips Lamps, Ltd., 143, Charing Cross Road, W.C.2.

Braybar. No. 577373. Class 13. Electric immersion heaters of ordinary metal.—George Bray & Co., Ltd., Bagby Works, Leicester Place, Leeds.

Presmet. No. 579183. Class 13. Electrodes of ordinary metal for electric welding. No. 579148. Class 18. Electric welding plant.—British Insulated Cables, Ltd., Prescot, Lancs.

Netherlands East Indies Electrical Imports

IN our issue of August 27th we abstracted a report by Mr. L. B. S. Larkins, British Commercial Agent at Batavia, in which we showed the trend of the electrical trade in the Netherlands East Indies. We now give below figures relating to the electrical import trade of Java and Madura, based on the recently issued official trade returns. The sterling rate for the guilder in 1936 varied between 7¾d. and 9¼d.

In addition to the imports shown above into Java and Madura, there is a growing trade in electrical material with the other islands of the Netherlands East Indies. Last year the total value of dynamos, motors, transformers, &c., imported into these Outer Possessions amounted (in thousands of guilders) to 335, compared with 192 in the previous year with Holland, Germany, Switzerland, and the United States, the principal suppliers; accumulators, 45, with the United States and Germany leading in the trade; radio apparatus and parts, 112, with Holland the chief supplier; radio valves, 60, with Holland almost the only supplier; electric lamps for cycles, torches and motor cars, 56, and other electric lamps, 208, with Holland again predominating.

	1936 Guilders (000)	Inc. or dec. on 1935 Guilders (000)
Electric cable—		
Total	352	+ 131
From Holland	186	+ 60
„ Germany	125	+ 97
„ Japan	35	— 6
Electrical installation material for buildings, unspecified—		
Total	509	+ 195
From Holland	257	+ 136
„ Germany	225	+ 46
Batteries for torches—		
Total	284	— 65
From China	73	— 13
„ Hong Kong	97	— 69
„ Japan	109	+ 21
Accumulators—		
Total	183	— 119
From Holland	48	— 80
Accumulators (continued)—		
From United States	36	— 18
„ Japan	49	— 17
Radio material and apparatus—		
Total	1,004	— 72
From Holland	786	— 58
„ Great Britain	55	+ 20
„ Germany	60	— 5
„ United States	56	— 5
Radio valves—		
Total	580	+ 40
From Holland	538	+ 59
„ United States	20	— 18
Dynamos, motors, transformers and rotary convertors—		
Total	285	+ 14
From Holland	79	+ 12
„ Germany	117	+ 6
Pocket and bicycle lamps with batteries—		
Total	192	— 4
From Hong Kong	107	*

* Comparable figures not available.

	1936 Guilders (000)	Inc. or dec. on 1935 Guilders (000)
Electric lamps for cycles and torches—		
Total	95	— 4
From China	61	+ 15
„ Japan	21	— 6
Electric lamps for motor cars—		
Total	26	+ 7
From Holland	18	+ 8
Electric lamps, other—		
Total	728	+ 119
From Holland	543	+ 135
„ Germany	84	— 3
„ Hungary	45	+ 12
„ Japan	47	— 27

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alfreton.—Houses (44), Birchwood Lane, Somercotes; R. F. Ward, surveyor, Council Offices.

Altrincham.—Houses, Quarry Bank estate, and flats and bungalows, Moss Lane; H. E. Brown, borough surveyor.

Arbroath.—Houses (100); burgh surveyor.

Aylesbury.—Alterations and additions to Council Offices, Buckingham Street; R.D.C. surveyor.

Ayr.—Cinema (£40,000), for the Odeon Circuit of Cinemas; Robert Pert & Sons, Ltd., contractors, Montrose.

Beaumaris.—Houses (30); Griffith Davies, borough surveyor, Municipal Buildings.

Birmingham.—Factory, Fazeley Street, for Charles Clifford & Sons, Ltd.; S. G. Jones, contractors, Victoria Road, Aston.

Blackburn.—Houses (50), Wensley Fold estate; H. G. Mason.

Bournemouth.—Odeon cinema, Christchurch Road; Elcock & Co. Extensions to High School for Girls, Branksome Hill Road; Governors.

Bridgend.—Shell filling factory; Sir Robert McAlpine & Sons, 50, Pall Mall, London, S.W.1.

Brighton.—Cinema, London Road, Patcham; Gaumont British Picture Corporation, Ltd. Factory, Edwin Place; W. I. Taylor. Flats and shops, High Street, Rottingdean; Central London Property Trust, Ltd. Offices and warehouse, William Street; M. Freeman & Co., Ltd. Shops and offices, West Street; Progress Buildings, Ltd.

Burnley.—Medical wards, Victoria Hospital (£12,000), for the Board of Management; secretary.

Cardiff.—Houses (376), Highmead estate; city engineer. Shop premises, Cowbridge Road and Grand Avenue; A. H. Bowyer & Son. Underground airport and bombproof shelter, Wood Street; E. Turner & Son, builders, Cardiff. High School, Colchester Avenue (£41,926); C. Brown & Co., Ltd. R.C. Senior school, Grand Avenue; Archbishop of Cardiff.

Chester.—Additions to the Clatterbridge County Hospital; F. Anstead Browne, architect, The Castle, Chester.

Chesterfield.—Houses (80), Bacons Lane estate; borough engineer, 2, Glumangate, Chesterfield.

Coventry.—Two R.C. schools (£32,000); F. H. Harrod, director of education.

Crook.—Bus station; W. Ayton, council surveyor.

Darlington.—Cinema, Bondgate; Darlington Trust, Ltd., 36, Priestgate.

Dawley.—Houses (72), Little Eyton site; J. H. T. Hickman, architect, Market Street, Wellington, Shropshire.

Doncaster.—Enlargement of Grammar school (£73,398), for E.C.

Dorset.—Clinic, Clyde Path Road, Dorchester, for C.C.

Dudley.—Branch bank, Birmingham Road, for the Westminster Bank, Ltd.; Harvey and Wicks, architects, 5, Bennett's Hill, Birmingham.

Durham.—Houses, Bowburn and Croxdale; H. Pescod, housing architect.

Easington.—Houses (422); C. W. Clarke, R.D.C. surveyor.

Edinburgh.—Public library and Nelson Memorial Halls, Dundee Street; J. Grant, 25, Rutland Square. Primary St. Francis school (£7,500) and intermediate school, Pitton; E. J. MacRae, City Chambers, Glasgow.

Ellon.—Houses, Station Road area; E. L. Williamson, 154, Union Street, Aberdeen.

Exeter.—Refittings, schools (£10,500), for E.C.

Felling-on-Tyne.—Swimming baths and public library; U.D.C. surveyor.

Girvan.—Lido (£250,000), Carleton estate, promoted by Confederation Securities, Ltd., 4, Queen Victoria Street, London, E.C.4.

Glamorganshire.—Extensions to girls' school, Gowerton (£38,310), for County E.C.

Glasgow.—Depot and offices, Salkeld Street; Leyland Motors, Ltd. Premises for Notre Dame High School for Girls; Sister Superior. Shops and offices, Westmuir Street; J. & W. Mackay. Alterations to Broadway Cinema, Amulree Street; Odeon Theatres, Ltd. Extensions to factory, Fielden Street; Acme Wringers, Ltd. Extensions to Tube factory, Edmiston Drive; Munro & Miller, Ltd. Extensions to works, Murano Street; Chance Bros. & Co., Ltd.

Gorleston-on-Sea.—Cinema, High Street; L. F. Richardson.

Gosforth.—Stores, North Road, for the Newcastle Co-operative Society; C.W.S. Building dept., West Blandford Street, Newcastle-on-Tyne.

Gravesend.—Elementary school, Westcourt estate; borough architect.

Great Yarmouth.—Extensions to factory, St. Nicholas Road; Grout & Co., Ltd.

Greenock.—Twelve shops and houses, Gibbshill and Bowston sites; A. and C. Edelman, Ltd.

Hamilton.—Headquarters for Works Department (£11,500); burgh surveyor.

Hebburn-on-Tyne.—Houses (22), Crawley Avenue; S. and H. Oake, Victoria Road West. Shop and extensions to boiler houses for A. Reyrolle and Co., Ltd.; architects, 21, Ellison Place, Newcastle-on-Tyne. Additions to Hebburn Hall Infirmary (£10,000); P. L. Browne, Son and Harding, architects, Pearl Buildings, Newcastle-on-Tyne.

Hythe.—Premises, Cambridge House, for Folkestone Co-operative Society, High Street.

Ipswich.—Estate development, near Sidegate Lane; S. P. Upshall. Senior and junior schools (£60,200); G. A. Kenney & Sons.

Keighley.—Houses (101), Guard House estate (No. 2); E. G. FFelgate, borough architect, Gas Offices, Cook Lane.

King's Lynn.—Houses (130), Gaywood Hall estate, Scheme No. 15; J. C. Matthew, borough engineer, Town Hall. Two schools and building containing canteen, kitchen, caretaker's flat, &c., for E.C.; N. Wheatley, school architect, Education Office.

Lancashire.—School, Mansfield estate, Brierfield (£26,300), for County E.C.; county architect, County Offices, Preston.

Leeds.—Administrative buildings and hangar, Yeadon Aerodrome; city engineer, Civic Hall.

Leicestershire.—Library, The Square, Market Harborough, for C.C.

Leigh.—Houses (145), Etherstone site; T. A. Clare, borough surveyor.

Limehurst.—Houses (48); R. Thompson, surveyor, Council Offices, Oldham Road, Waterloo, Ashton-under-Lyne.

London.—(CAMBERWELL).—Health centre, Camberwell Road; borough engineer. Reconstruction of Peckham depôt (£20,795); Galbraith Bros., Ltd., 71, Waterloo Street, S.E.5. (ISLINGTON).—Tenements (237), Hornsey Lane (£133,174); Geo. Walker & Slater, Ltd. (WANDSWORTH).—Library, Eardley Road, Streatham Vale; borough engineer, Municipal Buildings, Wandsworth High Street, London, S.W.18.

Longbenton.—Houses, Croft estate; U.D.C. surveyor.

Lowestoft.—Houses (20), Long Road; P. C. & H. W. Easey. Development of Gunton Hall Farm estate; P. V. Huckle.

Manchester.—Offices to works, Worsley Street, Hulme, for T. Hulbert & Sons, Ltd., 30, Worsley Street; Thorpe & Smith, architects, 66, Deansgate, Manchester. Alterations and additions to laundry, Cheetham Street, Cheetham, for the Prospect Laundry Co.; J. H. Cassel & Co., contractors, 297, Bury New Road, Manchester. Additions to works, Teviot Street and Richmond Grove, Longsight, for J. B. Rogers & Co., Ltd., Richmond Grove; A. Hodkinson, Ltd., builders, 62, Greenhill Street, Ardwick.

Motherwell.—Premises, Broadway Street, for Claude Alexander; Whyte and Galloway, 121, Bath Street, Glasgow.

Northamptonshire.—Additions to Brackley High school, including hall-gymnasium, cloakrooms, &c., for C.C.; county architect, County Hall, Northampton.

Norwich.—Houses (46), Earlham Green Lane, and extensions to maternity home (£20,310) and Wensum baths (£8,813); city architect. Cinema, North side of Dereham Road, for the V.E.H. Cinemas, Ltd.; J. Owen Bond & Son, architects, Tombland. Library, Thorpe (£4,840); John Holmes & Son. School, Earlham estate, for E.C.

Nottinghamshire.—School clinic and tuberculosis dispensary, Worksop, for C.C.; H. James (Mansfield), Ltd., contractors, Station Street, Mansfield.

Oldham.—Shops, Albion Street, for the Markets and Baths Committee; Whitworth Whittaker, Ltd., contractors, Rochdale Road.

Peterborough.—Nursery block and female casual and receiving ward. Public Assistance Institution, for C.C.; W. L. Seamer, Queen's Drive, Peterborough.

Portishead.—Houses (13), Bristol Road site; S. Colburn & Son, builders, Bristol.

Portland.—Houses, Tillycombe estate (£24,102); St. George's Building Works, Ltd. Offices, Park Road; Bath & Portland Stone Firms, Ltd.

Rhyl.—Arcade of shops to replace the old market; surveyor, Town Hall.

Richmond (YORKSHIRE).—Houses (56), Reeth Road; W. Thompson, builder, Northallerton.

Rochdale.—Houses (50), Buersil estate, Oldham Road; R. & H. Fletcher, Ltd., builders, Victoria Chambers, Cleveleys.

Rothbury (NORTHUMBERLAND).—Houses (30); Hetherington & Wilson, architects, 52, Westgate Road, Newcastle-on-Tyne, 1.

Rushden.—Houses, Hall Avenue; M. M. Drabble.

Rutherglen (LANARKSHIRE).—Child welfare centre; burgh surveyor.

St. Albans.—Houses, Sleap's Hyde (£13,556); H. N. Martin, Ltd., contractors, Bushey.

Sheffield.—Additions to the University Buildings (£250,000). Western Bank; T. Lodge, architect, 19, Bedford Square, London, W.C.1.

Southampton.—Senior Elementary School for Girls (520 places), Andover, and additional classrooms, assembly hall, &c., to the Council school, Whitchurch, Hampshire; A. L. Roberts, county architect, The Castle, Winchester.

Southend-on-Sea.—Children's home, Shoeburyness (£17,950), for P.A.C.; Flaxman & Sons, Ltd., builders, Southchurch Road, Southend-on-Sea.

South Shields.—Houses (350), Horsley Hill; borough engineer.

Staffordshire.—School, Stafford (£32,089), for County E.C.

Stanley (Co. DURHAM).—Swimming baths; U.D.C. surveyor.

Stockton-on-Tees.—Houses, Durham Road, for H. Cohen, High Street, and shop premises, Durham Road, for Teasdale & Co.; G. P. Stainsby, architect, 25, High Street. Houses (18), Hermitage Road; Moorhouse & Barker, builders, Thornaby-on-Tees. Shop premises, High Street, for Blackburn & Co.; Kitching & Co., architects, 21, Albert Road, Middlesbrough. Extensive alterations to premises, Bowersfield Lane, for Athole G. Allen, Ltd.; S. Grabham, architect, 163, Albert Road, Middlesbrough.

Stretford.—Houses (108), Barton Road (£74,928); E. Parker, borough surveyor.

Uxbridge.—Houses (50), Rockingham Road, the Lynch, and Hillingdon; W. L. Elves, U.D.C. architect, 54, High Street, Uxbridge.

Washington (Co. DURHAM).—Houses, Washington Station and Heworth Road; U.D.C. surveyor.

Wellingborough.—Extensions to factory, London Road, for Almarco Metal Windows, Ltd.

Wylam (NORTHUMBERLAND).—Additions to Convalescent Home (£10,000); Newcombe & Newcombe, architects, 23, Eldon Square, Newcastle-on-Tyne.